TELEMATIC MUSIC: HISTORY AND DEVELOPMENT OF THE MEDIUM AND CURRENT TECHNOLOGIES RELATED TO PERFORMANCE

Mark Cook

A Dissertation

Submitted to the Graduate College of Bowling Green
State University in partial fulfillment of
the requirements for the degree of

DOCTOR OF MUSICAL ARTS

December 2015

Committee:

Roger Schupp, Advisor

Bonnie L. Mitchell
Graduate Faculty Representative

Elainie Lillios

Conor Nelson

ABSTRACT

Roger Schupp, Advisor

Telematic music is a little-known sub-genre of telematic art and a new phenomenon in the world of music. This paper seeks to provide aspiring telematic musicians with the necessary knowledge and background that will enable them to participate in this art form by supplying a historical and aesthetic background for the elements of telematic art, discussing commonly used technologies and how they are implemented today, investigating performers who employ telematics, and examining the telematic opera *Auksalaq*. Additionally, this paper explores the adaptation of telematic art into telematic music.

Chapter I reviews artistic and technological precursors of telematic art, centered around its three main aspects: telematics, integration of art forms, and interactivity. Chapter II provides a general guide for the aspiring telematic musician, covering the unique variables associated with performing telematically and giving practical advice relating to topics such as choosing technology, preparing telematic music, and more. Chapter III explores the current state of telematic music and creates a framework for analyzing it. This chapter includes an interview with Scott Deal, an accomplished musician and telematic artist and also discusses *Auksalaq*, one of the most ambitious telematic art projects to date.

To my loving wife, without whom I would never have succeeded.

ACKNOWLEDGMENTS

I am eternally grateful to the guidance of many people, and the support of many more. First, my deepest gratitude goes to my advisor Dr. Roger Schupp for all of his encouragement, patience, support, and guidance through the entirety of my doctoral degree, including several very challenging years. Second, I am deeply indebted to Dr. Marilyn Shrude, who has been my advocate throughout my doctoral degree and has been incredibly supportive of all my musical endeavors. I would also like to extend my thanks to the rest of my committee, including Bonnie Mitchell, Dr. Elainie Lillios, and Dr. Conor Nelson for their invaluable assistance and patience in my pursuit of this degree.

I especially wish to thank Dr. Scott Deal, who originally showed me this unique art form and then was kind enough to really encourage and guide me in my learning process. His help both in giving an interview and all of the additional sharing of knowledge he has done has been invaluable.

Finally I wish to thank my family for all of their unconditional love and support. In particular, I am forever grateful to my wife Amy for everything.

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CHAPTER I: ARTISTIC AND TECHNOLOGICAL PRECURSORS OF TELEMATIC MUSIC

1.1 INTRODUCTION

Telematic music exists as part of an overarching umbrella of an artistic genre known as telematic art. The term "Telematic" is a neologism devised by Simon Nora and Alain Minc in 1978 for a report to the president of France and was created by combining two words: Telecommunications and Informatics.[1] Telecommunications can be defined as communicating over distance through the use of technology, and Informatics can be defined as a branch of science that deals with information. Therefore, the term telematic refers to sending and receiving information over a distance using technology. A prominent use of telematics in today's society is GPS, or the global positioning satellite system, which tracks and transmits location information to and from a device in real time.

Within telematic art, telematics as a term still refers to telecommunications technologies, but the art incorporates additional elements. Art today that employs telematics commonly uses the Internet as a telecommunications medium which takes individual pieces of a complete artwork and brings them together to create a conjoined whole. The following is an example of using telematics in music: two performers, each in a different geographical location, perform a piece of music together via the Internet. Audio and video are transported from one site to the other in real time and combined with the live audio and video in either or both. However, telematic art also includes other elements. Telematic art is defined by Roy Ascott, who discusses ideal telematic art in three ways in his essay "Is There Love in the Telematic Embrace?" First,

[1] Daniel Bell, introduction to The Computerization of Society by Simon Nora and Alain Minc. (Cambridge: MIT Press, 1980). Originally published as L'Informatisation de la société, (La Documentation Française: Paris, 1978), vii.

telematic art must use telecommunications technologies.[2] Second, it uses an integration of multiple art forms, which will be discussed in relation to the concept of the *Gesamtkunstwerk*.[3] And third, it involves audience participation.[4]

Roy Ascott's first criterion of telematic art, which is the inclusion of telematic or telecommunications technology into performance, most commonly involves high-speed transmission of large amounts of data via the Internet. While it is possible that there may eventually be other data transmission methods regularly used for telematic art, cost concerns, available data transmission speeds and current technologies have led to the Internet being the primary method for sending and receiving data. While data speeds are ever increasing, people are largely still limited in their ability to send data rapidly.

Ascott's second criterion, the *Gesamtkunstwerk,* or total art work, is an idea popularized by Richard Wagner in the 1870s. The concept is that all art forms are equal, meaning that music has the same importance as visual art (and vice versa) when they are combined. This integration of art forms together creates a new art form, the total art work. The *Gesamtkunstwerk* has seen many variations, but is not a predominant part of today's culture in this pure form. It is instead seen in multimedia in various forms, such as movies, television, opera, and ballet, among others.

In reference to audience participation, Ascott stated: "…the observer of an interactive telematic system is by definition a participator".[5] He believes that telematic art is by its very nature participatory. Ascott also stated that: "Telematic culture means, in short, that we do not think, see, or feel in isolation. Creativity is shared, authorship is distributed…"[6] Audience

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[2] Roy Ascott, "Is There Love in the Telematic Embrace?" In *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, edited by Edward Shanken, (Berkeley and Los Angeles, University of California Press, 2003), 231.
[3] Ascott, "Love in the Telematic Embrace," 232.
[4] Ibid., 237.
[5] Ibid., 233.
[6] Ascott, "Love in the Telematic Embrace," 238.

participation is an interesting and highly variable possibility in art, and an element that Ascott believes is necessary in most modern art.

In order to provide a foundation for telematic art, this chapter will first discuss historical aesthetic considerations, followed by a more detailed assessment of Ascott's three main telematic art elements. Finally, some aesthetic implications of telematic art will be explored.

1.2 HISTORICAL AESTHETIC CONSIDERATIONS

The history of telematic art can be traced through significant movements in the arts. Both the *Gesamtkunstwerk* and audience interactivity have ties to the genre of the avant-garde, with the *Gesamtkunstwerk* functioning as one idea that influenced the avant-garde, and audience interactivity becoming prominent during the avant-garde period. These two concepts will be discussed in depth later. Specifically, they share historical roots with Futurism, Dadaism, Expressionism and the German avant-garde, as well as with John Cage and the American avant-garde. These genres will be briefly introduced in order to provide simple definitions and contextualize the historical basis of this chapter.

While the term avant-garde can refer to many things, the artistic concept is quite often misunderstood and merely applied to anything experimental. In the context of this paper, the avant-garde refers to a general philosophical context as it relates to the arts, specifically as a philosophical movement that questioned how art was perceived, transformed formal definitions of art, and challenged the existing state of artistic affairs. The avant-garde, and all of the movements existing within it, rebelled against the contemporary view of art in the world. Some examples of how the avant-garde challenged the historical concept of art can be seen in its goals of undermining the concept of the masterpiece and altering the aura surrounding art. In order to

try to achieve these goals, the artists challenged the social status of art being for the elite, and worked to change the way art was seen, viewed, and understood. These elements are why the avant-garde is considered disruptive to many.

The earliest movement discussed in this paper is Futurism. The Futurists were a group of early twentieth century philosophers and artists who were primarily Italian or Russian.[7] They were passionate about the future, believing that technology and urbanization would come to permeate every aspect of life. They produced many manifestos expressing varied philosophical viewpoints, including artistic thoughts and beliefs about multimedia. In particular, the writings by F.T. Marinetti and his focus on creating a new cinema that embodied the *Gesamtkunstwerk* ideal foresee later telematics tenets. The Futurists' writings also routinely disregarded or disliked artwork of the past as they strove to cast off traditions and create new artwork of the future,[8] which foreshadow the beginnings of the avant-garde movement.

Expressionism was a European artistic movement that began around 1905 and lasted until approximately 1925. Expressionism can be characterized as a reaction against the conservative social values around the turn of the twentieth century and was intended to be direct and often startling. It is considered an example of an avant-garde artistic movement. In retrospect, Expressionism is largely applied to Austro-German visual art, specifically to the artistic communities Die Brücke and Der Blaue Reiter.[9] According to Ralf Beil, the label

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[7] Flora Dennis and Jonathan Powell, "Futurism" *Grove Music Online*. *Oxford Music Online*. Oxford University Press. Accessed September 17, 2014. http://0-www.oxfordmusiconline.com.maurice.bgsu.edu/subscriber/article/grove/music/10420.

[8] Paul Griffiths, "Futurism," *The Oxford Companion to Music*, *Oxford Music Online*, Oxford University Press, accessed September 17, 2014, http://0-www.oxfordmusiconline.com.maurice.bgsu.edu/subscriber/article/opr/t114/e2744.

[9] David Fanning, "Expressionism," *Grove Music Online*, *Oxford Music Online*, Oxford University Press, accessed September 16, 2014, http://0-www.oxfordmusiconline.com.maurice.bgsu.edu/subscriber/article/grove/music/09141.

"expressionism" essentially applies to non-traditional contemporary art of the time.[10] One of the aspects of German Expressionism was the desire to realize the *Gesamtkunstwerk* of Wagner, and earlier, Karl Trahndorff.[11] German Expressionism focused on contemporary political themes, including a focus on World War I and the war's aftermath.

As time progressed, the avant-garde became more established through one of its more prominent schools, Dadaism. Dadaism was a type of avant-garde art that was deliberately outrageous and inflammatory to the existing art world norms. It originated in Europe as a political reaction to World War I.[12] Dadaism focused on presenting normal objects in a distinctly different context, and then proclaimed them as art. One of the many statements this art made was that although an object is ubiquitous, well-known, or designed with a specific function; it can also be seen in a different light: as art. One of the most well-known figures of Dadaism is Marcel Duchamp, a man who greatly influenced John Cage, Fluxus, and many others. Duchamp created ready-mades, or found objects, which he presented in non-traditional and provocative ways. One of the most famous of his ready-mades was the work *Fountain*, which was simply a urinal put on its side.[13] This is one of many examples of how artistic thought of the time was rebelling against the status quo.

In the United States, the musical avant-garde was greatly influenced by John Cage. Cage is possibly the most important musical figure of the twentieth century in the United States, not necessarily because of his output, which is exceptional, but because of the philosophy he espoused, and, in particular, how he challenged the traditional definition of music. In general,

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[10] David Fanning, "Expressionism," *Grove Music Online*, *Oxford Music Online*, Oxford University Press, accessed September 16, 2014, http://0-www.oxfordmusiconline.com.maurice.bgsu.edu/subscriber/article/grove/music/09141.
[11] Ralf Beil, "The Total Artwork in Expressionism Foreword and Acknowledgements," In *The Total Artwork in Expressionism* edited by Ralf Beil and Claudia Dillman, (Ostfildern, Germany: Hatje Cantz. 1905-25), 14.
[12] Dawn Ades and Matthew Gale, "Dada," *Grove Art Online*, *Oxford Art Online*, Oxford University Press, accessed September 17, 2014, http://0-www.oxfordartonline.com.maurice.bgsu.edu/subscriber/article/grove/art/T021094.
[13] Ades and Gale, "Dada."

Cage believed that all sounds had equal validity in music, and that limiting which sounds were acceptable for use in music was wrong. Cage felt that this limitation narrowed perception of what music is.[14] Cage was greatly affected by Dadaism and Duchamp in particular, and his work evinced many of the same philosophies. By taking everyday sounds and declaring them musical, Cage criticized the idea of the masterwork in music. His thinking greatly influenced the American avant-garde artists who came after him, in particular the Fluxus artists, such as La Monte Young.[15]

While telematic art is related to the genres of art already mentioned through their links to both the *Gesamtkunstwerk* and audience interaction, there is an interesting divergence that occurs in the overall artistic thinking between telematic art and the avant-garde. This is due to Ascott's focus on technology as the driving force of telematic music, as opposed to the artistic idea of the avant-garde. Telematic art is seen by Ascott as an inevitable feature of the future; it will uncontestably come about as the natural synthesis of many different factors: art, technology, globalization, etc. Ascott's idea is very representative of a teleological view that a concept, such as technology, will inevitably continue as an evolution from the past all the way through the future until it reaches a point of perfection. The teleological idea is diametrically opposed to a prominent ideal of the avant-garde, which was focused on trying to recreate the essential definition of what art is, as opposed to building upon current ideals. This difference emphasizes that Ascott's aesthetic thinking about telematic art is informed by his teleological view of technology, thus incorporating different viewpoints that exist outside of the artistic realm at the

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[14] "Cage, John," *The Oxford Dictionary of Music, 2nd ed. rev. Oxford Music Online*, Oxford University Press, accessed September 17, 2014, http://0-www.oxfordmusiconline.com.maurice.bgsu.edu/subscriber/article/opr/t237/e1694.

[15] Branden, Joseph, "*HPSCHD*—Ghost or Monster?" In *Mainframe Experimentalism: Early Computing and the Foundations of the Digital Arts*, edited by Hannah B. Higgins and Douglas Kahn, (Berkeley and Los Angeles, University of California Press, 2012), 154.

time. Ascott's view of telematic art is a derivation of his opinions about technology, and his belief that as technology becomes more sophisticated, mankind moves towards existing as a collective, rather than as an individual, while the avant-garde presents an artistic viewpoint of change. Ultimately, telematic art favors the technological perspective rather than the avant-garde.

1.3 THE *GESAMTKUNSTWERK*

Multimedia refers to the combination of media in a single setting. This idea has a very long history in the Western world. Richard Wagner promoted the idea of multimedia in his 1849 essay "The Artwork of the Future" in which he described an integration of art forms, or media, into a single work termed *Gesamtkunstwerk* by Trahndorff in an earlier essay.[16] The *Gesamtkunstwerk* was a new concept that insisted that the synthesis of all forms of art in a work could create something greater than any of the single elements. Wagner's attempt at creating this combination of art forms was his operatic cycle *Der Ring des Nibelungen*, which includes numerous components of integrated arts. For example, each person or important item that appears on stage has its own leitmotif, a musical motive that symbolizes something within the opera, such as a person, item, or concept. Wagner coined this term to illustrate his intent to create purposeful connections between the opera's characters and their motivic accompaniments. It is conceivable that the opera could be interpreted solely by the music, thus establishing that the music alone is equal to the other individual elements of the artwork. This thought carries with it the idea of the *Gesamtkunstwerk*, namely that any single art form of the work is equally valid to any other element, while the ultimate expression of the work is shown by the synthesis of the art forms. This concept has been adapted and reshaped by various people over time, including Roy Ascott for telematic art.

[16] Ralf Beil, "The Total Artwork in Expressionism," 14.

Multimedia, when interpreted through the lens of Wagner's *Gesamtkunstwerk*, is the combination of different media to create a whole that is greater than the sum of its parts. A whole where removing any portion of it, any one particular medium, would destroy it; or a creation in which each part is a vital contribution to the whole. Media in this sense consists of sound or music, visual content, physical elements, and written or spoken expressions. This combination of media has been appropriated and applied broadly in the entertainment world and is pervasive in the world today.

There is, however, a difference between the Wagnerian ideal and most contemporary multimedia. In the *Gesamtkunstwerk*, all art forms share equal importance, a clear difference from most popular forms of multimedia. While, in fact, it is true that film, ballet, opera, and countless other types of multimedia exist, they may not have this approach that all the art forms are equally important to the final product. This can easily be seen by imagining a typical movie today: without the musical soundtrack, the standard film could still exist and succeed, though perhaps with less impact or clarity than might be the case with the soundtrack. Therefore, it is not necessarily essential for a standard film to contain music, though most do, and it is implausible in an archetypal movie for the soundtrack of the film to convey the entirety of its meaning.

However, the cinema, or any art form, can incorporate the ideals of the *Gesamtkunstwerk*. This incorporation is not prominent, but is certainly possible. In an essay published in 1916, *Gesamtkunstwerk* and the cinema were considered as a serious artistic endeavor by the Futurists.[17] In "The Futurist Cinema" by F.T. Marinetti, the priority of creating a holistic multimedia work was made abundantly clear. "Painting + sculpture + plastic dynamism + words-

[17] Marinetti et al, "The Futurist Cinema," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 11.

in-freedom + composed noises (*intonarumori*) + architecture + synthetic theatre = Futurist Cinema."[18] This quote illustrated that in the Futurist mindset, ideal cinematic creation requires multiple art forms. Marinetti insisted that the cinema is an "autonomous art"[19] and that it should never copy the stage. He characterized the cinema as the medium of the future, replacing literary review, drama, and the book as the ultimate expressive device.[20] While most films do not necessarily embody this ideal, some have been specifically designed to do so, creating a clear difference between these two approaches to film.

Another example of a cinematic ideal for the *Gesamtkunstwerk* comes from German Expressionism. Arnold Schoenberg developed a film focused on the concept of the total artwork around 1913 called *Die glückliche Hand* (*The Fortunate Hand*).[21] Schoenberg envisioned a painter such as Kandinsky creating the scenes, filled with music, and the film would be colored by an artist after it was recorded to his specifications.[22] *The Fortunate Hand* was designed to be synesthetic, engaging multiple senses in a further interpretation of the *Gesamtkunstwerk*. Schoenberg, being a musician, related many aspects of *The Fortunate Hand* to music, comparing lights and gestures to tones, and stating that he was trying to make the medium of the stage into music.[23] It was an eighteen-minute dream with incredible specificity in all areas that typified this presentation of the *Gesamtkunstwerk*.

Simultaneously in 1920s Germany, a new look at integrating art forms was taking place. In 1929 Walther Ruttmann, an important German avant-garde filmmaker, created the film

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[18] Marinetti et al, "The Futurist Cinema," 15.
[19] Ibid., 12.
[20] Marinetti et al, "The Futurist Cinema," 11-12.
[21] Ralf Beil, "For Me There Is No Other 'Work of Art' The Expressionist Total Artwork—Utopia and Practice," In *The Total Artwork in Expressionism* edited by Ralf Beil and Claudia Dillman, (Ostfildern, Germany: Hatje Cantz. 1905-25), 31.
[22] Ibid., 31.
[23] David Roberts, *The Total Work of Art in European Modernism,* (Ithaca, New York, Cornell University Press, 2011), 157-158.

Melodie der Welt, or *World Melody*. In it Ruttmann explored a new idea in film: juxtapositioning unrelated media together to create new relationships. In the note to *World Melody* he states: "You hear: an explosion. You see: a woman's horrified face."[24] This example contrasts with what one might normally see in film, such as seeing and hearing an explosion at the same time. This is a different application of the *Gesamtkunstwerk* zeitgeist, but it remains an example of the *Gesamtkunstwerk*, because it still represents the integration of visual and audio elements to create something new.

In 1924 Laszlo Moholy-Nagy moved another step forward into conceptualizing an equal multimedia art form. In his essay "Theater, Circus, Variety" he railed against current and historic theatrical practices, claiming that they missed the point. Moholy-Nagy argues that the Futurists and the Dadaists were not accurately portraying the whole picture because they wanted to remove the literary aspects of theater shown by the actors.[25] Moholy-Nagy believed that man, as an actor, embodies literary aspects of theater, and is either the most prominent feature of a theatrical piece; or as in the Futurist and Dadaist theater, has been removed altogether. He theorized that instead of removing the actor or making him the central element, man's function should be equal to any other media elements such as light, sound, form, or music. This is the clearest reimagining of the concept of total art, which reduces even the performer to merely another aspect of the artwork instead of the dominant component.

Later in the twentieth century, the concept of the total artwork and multimedia are once again brought to the forefront of American artistic thinking by the avant-garde group Fluxus. Fluxus was a group of artists well known in the American avant-garde and often associated with

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[24] Walter Schobert, "Painting in Time and Visual Music: On German Avant-Garde films of the 1920s," In *Expressionist Film – New Perspectives*, edited by Dietrich Scheunemann, (Rochester, NY, Camden House 2003), 245.

[25] Laszlo Moholy-Nagy, "Theater, Circus, Variety," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 19.

Dada, John Cage, and other influential artists. Some Fluxus members have widespread name recognition such as Yoko Ono, but the group also included many people from a variety of artistic disciplines, including La Monte Young, Richard Higgins, Nam June Paik, and more. They explored new artistic concepts and expanded the arts experience through their artistic events. These events utilized a variety of new philosophical and theatrical elements to change the experience of the audience. One example is a portion of La Monte Young's work *Compositions 1960*, where a butterfly is released in the performance space and the piece lasts until the butterfly leaves. Fluxus produced a variety of these performances. Sometimes they were called concerts, but the larger events became known as "Happenings," a term coined by Allan Kaprow.[26] These events were a type of performance that most commonly falls into a category called performance art. The difference between a Fluxus concert and a Happening was mostly one of scale and complexity. Happenings could occur at any location and defy description, largely because they were incredibly individualized, but also because they were meant to be an occurrence of something difficult to describe or understand.[27]

During the avant-garde art period, the breakdown of established ideals, particularly the artistic norms that had existed for hundreds of years, was a necessity. In the place of these established standards new concepts arose; however, these elusive new concepts were a difficult thing to describe or understand, and many people had their own ideas of what should be put in their place. Happenings and a new type of media called intermedia were Fluxus ideas. Richard Higgins, the author of the article "Intermedia" described intermedia as existing between media, and used an example to illustrate his point. He said, "I cannot, for example, name work that has

[26] Richard Higgins, "Intermedia," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 30.
[27] Higgins, "Intermedia," 32.

consciously been placed in the intermedium between painting and shoes."[28] His point seems to be that while there are shoes as a function of everyday life and there are paintings, there is a space in the dichotomy between them that can be filled, and in fact, exists, as intermedia. Applying this concept to telematic music suggests that there is music, and there is telecommunications technology, and telematic music exists as one type of intermedia between them. Intermedia can, and perhaps should, be viewed through the historical lens of multimedia and total art as a new conceptual view of interrelating art forms and how they connect to the world at large.

In relationship to Telematic art, intermedia is an important concept, and shows how diverse the roots and historical foundations of Telematic art can be, particularly in reference to the *Gesamtkunstwerk*. The *Gesamtkunstwerk* and its various iterations do not lend themselves to a monolithic singular entity. Rather, it seems more appropriate to say that these representations embody a zeitgeist that moves forward in time, a visible representation of the forward thinking artists and philosophers from the 1870s onward.

In 1990, when Ascott adapted the concept of the *Gesamtkunstwerk* for Telematic art, he labeled a new type of content which he called the "*Gesamtdatenwerk*" or the integrated data work. Ascott's view of the *Gesamtdatenwerk* was derived from his belief that technology is a driving force behind art, pushing towards a synthesis of the arts. Ascott described this in "*Gesamtdatenwerk*: Connectivity, Transformation, and Trasnscendence" from 1989: "We search for synthesis of image, sound, text. We wish to incorporate human and artificial movements, environmental dynamics, and ambient transformations all together into a more seamless

[28] Higgins, "Intermedia," 30.

whole."[29] As such, both technology and multiple art forms are necessary to create the Gesamtdatenwerk.

1.4 TECHNOLOGY

The technological element of telematic art, namely the use of telematics, is telecommunications-based and thus the simplest and easiest characteristic to identify. The most commonly used type of telecommunications technology in the realm of telematic music is software that allows video, audio, or both to be transmitted over the Internet using a computer through what is known as video conferencing software. While there are many types of video conferencing software, there are only a few that have been specifically used with telematic art or that have been created with some of the same processes in mind. As a result, each element of telematics-supporting technology developed separately.

1.4.1 The Computer

During World War II, the first computers, which were initially designed as calculating machines, were developed.[30] One of the earliest examples of this type of device was the Harvard Mark I, completed in 1943.[31] It was not electronic, and therefore was quite slow compared to other systems being developed at the time.[32] As time progressed, these computers reduced in size and continued to become more sophisticated as they moved toward becoming electronic. It did not take long before Vannevar Bush, an American engineer who headed the Office of Scientific

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[29] Roy Ascott, "Gesamtdatenwerk: Connectivity, Transformation, and Trasnscendence" In *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, edited by Edward Shanken, (Berkeley and Los Angeles, University of California Press, 2003), 226.
[30] Randall Packer and Ken Jordan, "Overture," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), xv.
[31] Christos Moschovitis, *History of the Internet: a chronology, 1843 to the present*, (Santa Barbara, Calif: ABC-CLIO, 1999), 22.
[32] Moschovitis, *History of the Internet*, 22.

Research and Development during World War II, saw the potential of these devices and drafted one that individuals could use to help them manage files and information.[33] This was unique for the time because it was one of the earliest examples of using computers for purposes other than mathematics. Bush's idea was the concept for the personal computer, something that was not to be developed for approximately thirty years.

The earliest example of a computer that resembles what we use today is the Xerox Alto. In the 1970s, Alan Kay developed an idea which he called the Dynabook – a computer that was interactive and able to integrate all media, and include hyperlinks.[34] Unfortunately, this project remained a prototype and was never built, but many new ideas were created during the project's research and development.[35] One of these was the graphical user interface, or GUI, which was incorporated into the first true multimedia computer, the 1973 Xerox Alto.[36] After the Xerox Alto, several other computers with GUIs, including the 1983 Apple Lisa were developed. The Macintosh, which was introduced in 1984, was significantly cheaper than other computers that used both a GUI and mouse.[37] The Macintosh, along with many computers developed concurrently and influenced by it, was the precursor to the personal computers we use today.

1.4.2 The Internet

The Internet has its roots in the 1960s, when many different countries were independently working on similar high-speed communications ideas. In the United States, the impetus for the Internet largely came from the Advanced Research Projects Agency (ARPA), which began work

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[33] Packer and Jordan, "Overture," xv.
[34] Ibid., xvii.
[35] Ibid., xvii.
[36] Ibid., xvii.
[37] David Hailey and Aimee Kilpack, "Section 1: history of writing technologies," *Technology for Professional Writing: An examination of the tools writing professionals should know*, Accessed September 17, 2014. http://imrl.usu.edu/oslo/technology_writing/004_003.htm.

on what became known as the ARPANET in order to share limited computer resources.[38] Joseph Licklider, the director of ARPA's Information Processing Techniques Office,[39] was the first person to truly conceive of the Internet in the way we now see it: as a network that links people together regardless of distance by allowing them to communicate through their computers.[40] Also in the early 1960s, an American engineer named Paul Baran was working on high-speed national communications systems at the RAND Corporation, which also supported national defense.[41] Baran wrote a paper outlining the idea of packet switching, which involved digital data being separated into small units, then distributed over a network and reassembled into a complete message on the receiving end. Another crucial advancement during this time was the creation of hyperlinking. This term, describing the ability to connect discrete texts together, was coined by American information technology pioneer Ted Nelson.[42] Nelson's idea eventually evolved into today's version of hyperlinks – uniform resource locators, or URLs used to connect discrete webpages on the Internet.

These ideas and others were integral to the creation of the ARPANET, which took place in 1969.[43] This was the first network of its kind, and while its creators had no idea just how much it would change the world, it was the first step towards a revolution in telecommunications. In 1971 ARPANET developments led to email.[44] American programmer Ray Tomlinson created multiple programs that could be used for sending, receiving, and transferring messages online.[45] Shortly thereafter in 1974, the TELENET (a public twin to the

[38] Moschovitis, *History of the Internet*, 34.
[39] Ibid., 48.
[40] Ibid., 37.
[41] Ibid., 45.
[42] Packer and Jordan, "Overture," xxv.
[43] Moschovitis, *History of the Internet*, 61.
[44] Ibid., 73-74.
[45] Ibid.,

military ARPANET) was established.[46] It linked people in multiple cities through computers and was the initial attempt at delivering networking to consumers.

By 1979, the ARPANET had grown to include more than one hundred different locations, mostly university computer science departments.[47] Eventually, it and other networks that had developed continued to grow until the Internet was officially defined in 1983 to include all networks that used Transmission Control Protocol and Internet Protocol (TCP/IP).[48]

Many of these advancements led to the 1989 introduction of the World Wide Web, designed by English computer scientist Tim Berners-Lee at the *Conseil Européen pour la Recherche Nucléaire* (CERN) in Switzerland.[49] While many people confuse the web as being the Internet, such is not the case. The World Wide Web is a platform that most people use on the Internet. This consists of documents and other resources that are identified by URLs, and are linked together using hypertext, which can be accessed via the Internet. [50] The Internet itself is the network of computers, not the content. The World Wide Web also allowed for interactivity over the web and facilitated the aggregation of other media, thus forming a new medium.

1.4.3 Video Conferencing

Video conferencing is an integrated part of our society. It affects our lives as we view reporters broadcasting from other countries on the television and inexpensively communicate with people around the world. We live in a world that most people would not have imagined possible thirty years ago. However, the idea of video conferencing actually has its roots long before then. Video conferencing is most closely associated with the Internet today, but before the

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[46] Moschovitis, *History of the Internet*, 79-80.
[47] Ibid., 102.
[48] Ibid., 109-110.
[49] Packer and Jordan, "Overture," xxvii.
[50] Packer and Jordan, "Overture," xxviii.

Internet, it was envisioned as an extension of the telephone. In its earliest form, video conferencing appeared in periodicals of the 1870s, such as *Punch* where a cartoon suggested the ability to view and speak with individuals over distance.[51] While the idea was clearly fanciful, it illustrates that video conferencing was already being considered as a possibility. In an 1891 document, Alexander Graham Bell expounded upon the possibilities of "seeing electricity."[52] The idea did not come to fruition until 1927, when the AT&T Ikonophone was created.[53]

After the Ikonophone, the next significant video technology update did not come until 1964, when AT&T showcased the Picturephone, which combined a video camera and screen with a telephone.[54] It debuted at The 1964 World's Fair in New York City, and had limited service in three cities later that year.[55] Although initially expected to be a commercial success, the Picturephone was ultimately a failure. The basic technology improved with time, but the videophone never achieved profitability. Although videophones still exist, they have largely been replaced by the smartphone, which includes the same functionality, but can use the Internet instead of always relying on telephone networks.

The videophone's limited success did not stop inventors from exploring the idea of communicating using video. In the 1990s, video technology came to the Internet. In 1994, the Quickcam was announced.[56] It was one of the first webcams available to consumers and introduced the ability to create live, web-accessible video. This advancing technology eventually

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[51] "Edison's Telephonoscope," Terra Media, Accessed September 17, 2014, http://www.terramedia.co.uk/Chronomedia/years/Edison_Telephonoscope.htm.
[52] Bell, Alexander Graham, "On the Possibility of Seeing by Electricity," Library of Congress, Accessed September 17, 2014, http://www.loc.gov/resource/magbell.37600601.
[53] "The Evolution of Videotelephony," Tech Update, Accessed September 17, 2014, http://www.techupdate.org.uk/evolution-videotelephony/.
[54] "The Evolution of Picturephone Service," *Bell Laboratories Record,* Vol. 47, no. 5, May/June 1969, Accessed September 17, 2014, http://www.beatriceco.com/bti/porticus/bell/pdf/picturephone.pdf, 160.
[55] "The Evolution of Picturephone Service," 161.
[56] Peter Ha, "Connectix QuickCam." *Time*. Accessed September 17, 2014, http://content.time.com/time/specials/packages/article/0,28804,2023689_2023703_2023628,00.html.

led to the current video conferencing options that continue to proliferate, a current popular example is Skype.

1.4.4 Integration of Computers, Internet Technology, and Art

While the previous section covers a very brief synopsis of the development of some of the general technologies used in telecommunications, this section will address the artistic use of technology. John Cage had been using technology since his 1939 piece *Imaginary Landscapes* which employs two turntables. *Musique concrète*, a French electroacoustic music genre in which natural sounds are used, was developed in 1948 by radio broadcaster Pierre Schaeffer and his associates. About one year later in Germany at the Westdeutscher Rundfunk, composer Karlheinz Stockhausen along with others began experimenting with tape music. In 1966 Billy Klüver, an electrical engineer at Bell Laboratories, wrote "The Great Northeastern Power Failure." In this article he suggested that artists up to this point in time (mostly referring to the Dadaists and Futurists) had a passive view of technology, meaning that they had allowed it to impact their art, but did not necessarily use it to create their art. He argued that technology was becoming an increasing part of our lives, and that it was inevitable that artists would make use of engineers in creating their art.[57] Cage also endorsed the idea of integrating technology and art: "Are we an audience for computer art? The answer's not No; it's Yes."[58] In *Diary: Audience 1966,* Cage also speaks about breaking down the divide between performers and audience: "Do you love the audience? Certainly we do. We show it by getting out of their way."[59] This

[57] Billy Klüver, "The Great Northeastern Power Failure," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 38.
[58] John Cage, "Diary: Audience 1966," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 92.
[59] Ibid., 93.

demonstrates Cage's interest in audience interaction as well. These essays reveal the efforts of the 1960s movement to integrate art with technology in a very significant way.

A final example of technological developments involves the use of the Internet and computer for interactive purposes. One of the most significant examples outside of web browsing is interactive computer gaming. An example of an interactive computer game called LambdaMOO was created in 1991 by American software architect Pavel Curtis and discussed in his 1991 essay *Mudding: Social Phenomena in Text-Based Virtual Realities*.[60] LambdaMOO is a MUD, or multi-user dungeon. MUDs are some of the earliest examples of games that feature interaction between players in a real time setting. LambdaMOO was an entirely text-based game, featuring a type of virtual reality in which users explored and interacted with the dungeon and each other. Users were able to chat with each other and create objects that other people could then interact with. This was the first example of an MMORPG, or massively multiplayer online role-playing game. These games are widespread now, and some notable examples include World of Warcraft and Lord of the Rings Online. Today's games are obviously more advanced, but most of the interactivity remains the same as the original MUD. People from all over the world are able to interact and communicate. This interaction has spread out from the MMORPG genre and has a foothold in most gaming today. Many Internet-based game providers allow users to interact with each other via an online chat service that can include text, audio, or video, regardless of whether they are playing a game or not. The most popular example of this type of provider is Steam. The ability to communicate while gaming has familiarized and normalized the interactive elements of the Internet in a very real way, demonstrating how technologies interact

[60] Pavel Curtis, "Mudding: Social Phenomena in Text-Based Virtual Realities," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 322.

outside of an artistic setting. These communication technologies can be used artistically in the same way, as an integral element of the experience of an artwork.

This section has provided a brief overview of the technological developments that make telematic art possible. Today's telematic art is incredibly varied, but generally uses computer-based software to transmit data of some kind for artistic purposes. This would not be possible without the creation of the multimedia computer or the Internet for personal use. The twentieth century brought about multimedia in technology. The interplay of technology with art now exists in much the same fashion.

1.5 AUDIENCE INTERACTION

In addition to Roy Ascott's first two criteria of incorporating telematics and integrating art forms, it is necessary to explore the third, that of audience interaction. When considering audience interaction in telematic art, it is important to understand Ascott's influences and his essays from the 1960s, when he was writing about "behaviourist art" and cybernetics.[61] Behaviourist Art, to Ascott, was a modern art form that had a different purpose than all other art prior to that point in time.[62] While he spoke specifically of the "visual/plastic arts," he noted that this change in function could refer to all types of art.[63] That this new change in art became "less descriptive" and "more purposive" highlights the significance that, for Ascott, art had shifted from being a factual representation or exploration, to being functionally concerned with behavior and purpose.[64] More to the point, in Ascott's opinion, "The boundaries between making art, the

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[61] Roy Ascott, "Behaviourist Art and the Cybernetic Vision," In *Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness*, edited by Edward Shanken, (Berkeley and Los Angeles, University of California Press, 2003).
[62] Ascott, "Behaviourist Art," 110.
[63] Ibid., 122-3.
[64] Ibid., 110.

artifact itself, and the experience of the work are no longer clearly defined."[65] In other words, the boundaries between traditional modes of viewing and relating to art had changed. This view carries forward and influences his thoughts about all modern art, and more specifically, all art that contains a technological component. He stated that current art, with its participation-oriented, inclusive form had a basic principle of feedback, and that circular progression created the new paradigm containing the artist, artwork, and observer.[66] To him, the artwork existed in a constant state of transition, and due to a greater flexibility of structures and images, allowed for much greater latitude in the interpretation of the artwork.[67] Essentially, the creator of the artwork set up the general conditions through which the audience could perceive the artwork, but the audience was responsible for the evolution and specifics of that perception and interpretation. He believed that the artists' motivation was to "primarily create a dialogue, to set ideas in motion, and to enrich the artistic experience with feedback from the spectator's response."[68] This, he claimed, was a cybernetic process of "retroaction."[69] The artwork became open ended, presenting the possibilities of many different outcomes which led to the active involvement of the spectator, who narrowed down the choices and created their own. This active involvement was the key point, and it created a framework for audience participation in telematic art.

In order to study audience interaction, it is important to understand that Ascott's view was linked to cybernetics, a transdisciplinary science with roots in the 1940s that studied how people, animals, and machines control and communicate information.[70] Cybernetic systems exist everywhere, and can be seen as intelligent systems that follow a specific pattern: action towards

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[65] Ascott, "Behaviourist Art," 111.
[66] Ibid., 111.
[67] Ibid., 111.
[68] Ibid., 111.
[69] Ibid., 112.
[70] Nobert Weiner, *Cybernetics; or, Control and communication in the animal and the machine*, (Cambridge, Massachusetts, MIT Press, 1948), 19.

achieving a goal, feedback on that action, evaluation of the feedback, and application of the evaluation to continuing actions.[71] Ascott initially discussed his early ideas of telematic art through a consideration of cybernetics and modern art during the 1960s. He believed that cybernetics and modern art could be incorporated into each other. This was before the concept of telematic art truly existed; however, as discussed above, telematic art had been hinted at and experimented with since the 1920s.

Audience participation relates to telematic art through the connection Ascott created between the idea of behaviourist art, cybernetics, and technology. He stated that "Cybernetics is consistent with behaviourist art; it can assist in its evolution, just as, in turn, a behavioural synthesis can embody a cybernetic vision."[72] Ascott argued that art had taken a cybernetic turn in its composition, as described by his behaviourist art ideals; therefore, approaching art through a cybernetic viewpoint was both possible and desirable. He next stated that the computer is the supreme tool of its era, and was expected to open up new possibilities and interactions with artifacts.[73] In his 1966-67 article "Behaviourist Art and Cybernetic Vision," Ascott took the technology of the day, the computer, and linked it to the creation of art in the future. "The interaction of man and computer in some creative endeavor…is to be expected."[74]

The definition of behaviourist art and the ideas of cybernetics are vital to telematic art because they led to Ascott's insistence that telematic art enable the audience to interact with the piece. The question is: to what degree is a contribution necessary before it can be considered participation? This question is essential, because all art that is observed constitutes an implied participation on the part of the audience in its smallest form, which means that the act of

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[71] Paul Pangaro, "What is Cybernetics?" Vimeo video accessed September 17, 2014, http://vimeo.com/41776276.
[72] Ascott, "Behaviourist Art," 127.
[73] Ibid., 130.
[74] Ibid., 129

observing art is in itself participation. At what point then, does the observer become actively involved in the outcome of the art? Is it purely through perception, or is the audience actually required to do something that will change the outcome of the artwork for everyone else as well as themselves? I believe that according to Ascott, anything that allows the audience interpretive choice becomes by its nature participatory.

The view that art is by nature participatory was promoted by Ascott and can be seen through the second half of the twentieth century in various forms. In 1977, American computer artist Myron Krueger explored the creation of interactive art through the use of computers.[75] Krueger wrote an essay titled "Responsive Environments" discussing his artistic approach through the narrative of his work.[76] Krueger considered the inclusion of interactivity to be a core element of his artwork. A similar thought process could be seen in the work of American artist Lynn Hershman, who argued "Despite some theories to the contrary, it is presumed that making art is active and viewing art is passive. Radical developments in communication technology, such as the marriage of image, sound, text, computers and interactivity, have challenged this assumption."[77] She went on to describe the feeling of empowerment felt by people who interacted with one of her pieces, entitled *Lorna*.[78] By 1990, the use of technology to promote interactivity in art had gained traction and exceeded the speculations of Roy Ascott.

Audience interaction is not a concept limited to technology. In fact, it has a long history of its own apart from technology, and can be seen as one of the influences on the art/technology paradigm. Many of the same works, thinkers, and ideas already discussed in Chapter 1 share an

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[75] Myron Krueger, "Responsive Environments," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 106.
[76] Ibid., 106.
[77] Lynn Hershman, "The Fantasy Beyond Control," In *Multimedia: From Wagner to Virtual Reality*, edited by Randall Packer and Ken Jordan, (New York, W. W. Norton and Company, 2001), 301.
[78] Ibid., 301.

interactive element as well as a zeitgeist of the *Gesamtkunstwerk*. This shared history between the *Gesamtkunstwerk* and audience interaction is interesting because these ideas were occurring at the same time to some of the same people.

In fact, it becomes clear that the *Gesamtkunstwerk* and audience interaction hold a very similar place in history, coming from some of the same major artistic movements, such as the Futurists and Fluxus. In his 1924 essay "Theater, Circus, Variety" Laszlo Moholy-Nagy discussed the audience in relationship to the theater and stated that it was time to produce theater "which will not only excite them inwardly but will let them *take hold and participate*…"[79] Moreover, during the 1960s, Fluxus artists experimented with and became known for promoting new methods of audience participation via Happenings. One example is Yoko Ono's *Cut Piece,* where the audience was invited to cut off pieces of her clothes and keep them.[80] The nature of audience interaction that Fluxus popularized was more integral to the art itself, and thus caused a more significant change in the outcome (e.g., once someone cut off Yoko Ono's sleeve, no one else could cut it off, and her arm was visible to everyone). These exchanges represented a different level of audience interaction, which was a change in scale, and not necessarily of type. While Fluxus writings do not interpret audience interaction through the lens of cybernetics, they can be clearly viewed in that context by considering audience participation as systemic feedback.

Feedback in this context – that is, combining cybernetic and artistic ideas – can have incredible variety as seen in the degree to which feedback can change a performance. In a recent performance of *Auksalaq*, a large-scale telematic artwork created by Matthew Burtner and Scott Deal, the audience was able to interact with the work in two ways. One, by using a computer program called NOMADS to influence sounds, and two, by inputting their locations into the

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[79] Nagy, "Theater, Circus, Variety", 25.
[80] Julia Bryan-Wilson, "Remembering Yoko Ono's 'Cut Piece'," *Oxford Art Journal,* Vol. 26, No. 1 (2003). Accessed September 17, 2014, http://www.jstor.org/stable/3600448, 101.

computer system, to be used as part of the text. These are two of an infinite number of possibilities for audience interaction, each of which create a different level of feedback. In fact, the synthesis of artistic ideas and cybernetic ideas suggests that the inclusion of feedback and its effects can be limited purely to an individual understanding of the outcome, affecting only the person who experiences that feedback and no other. Thus, it is impossible to say that audience interactivity must be overt. Ascott's writings suggest that he believes it is possible, or even likely, that what we view as a passive audience could in reality be part of a cybernetic system as long as the audience is intellectually engaged.

An example illustrating multiple levels of audience participation is John Cage's historic piece *4'33".* It is normally performed in three specifically timed movements that combine to four minutes and thirty-three seconds. The composition's musical content consists of silence, or more specifically, no voluntary sounds made by the performer. The performer can execute the three movements in various ways. At the work's premiere, pianist David Tudor closed and opened the lid to signify the beginning and end of each movement. Regardless of the performer's interpretation, the audience plays a very significant part in the piece. Today it is most commonly accepted that environmental sounds emanating from the audience, performer, and environment constitute the piece's music. Since sounds of each audience member contribute to the overall musical outcome, *4'33"* is an example of overt audience interaction. The choice of the audience to regard the work as art (or not) is also an example of audience interaction, as their feedback affects their perception of the performance.

Another example of audience interaction is *HPSCHD,* a multimedia, interactive event created by John Cage and Lejaren Hiller that occurred at the University of Illinois at Urbana-

Champaign in 1969.[81] *HPSCHD* was designed to be similar to but less intentional than the Happenings produced by Fluxus.[82] The piece consisted of seven twenty-minute harpsichord solos, fifty-one twenty-minute tapes of microtonal music created on a supercomputer, and slides projected onto movie screens. The recordings were to be set up all around the performance area and "audio men" would start the tapes randomly while performers played one of the seven harpsichord pieces at various times and intervals as desired.[83] The audience was instructed to wander through the area and focus on whatever they liked. This type of piece created a unique experience for each audience member and can certainly be seen as interactive, since audience members chose what to focus on, how to perceive it, and for how long.

The complexity of audience interaction can create a confusing scenario. Ascott believes that interaction is necessary for telematic art, but the question remains how do we determine whether the audience is having an interactive experience? The many variances seen in audience interaction in art, when viewed through a cybernetic lens, seem to be a difference of magnitude, not kind. It appears that as long as the intent is there on the artist's part, the remainder of the responsibility, in true cybernetic fashion, rests with the audience. This is clearly shown in Ascott's essay "Is There Love in the Telematic Embrace?" where he states "…the observer in an interactive telematic system is by definition a participator. In a telematic art, meaning is not created by the artist, distributed through the network, and received by the observer. Meaning is the product of interaction between the observer and the system…"[84]

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[81] Joseph, "HPSCHD," 147.
[82] Ibid., 155.
[83] Austin et al, "An Interview with John Cage and Lejaren Hiller" *Computer Music Journal*, (Vol. 16, No. 4, p. 15-29, Winter 1992), 22.
[84] Ascott, "Love in the Telematic Embrace," 233.

1.6 AESTHETIC IMPLICATIONS

In light of telematic art's historical background, the combination of all these disparate elements (telecommunications technology, audience interaction, and the *Gesamtkunstwerk*) has created a unique entity. This innovative idea of telematic art, then, has created a new set of aesthetic implications for artists. While there are many inherent aesthetic possibilities in each individual element of telematic art, this section will focus explicitly on specific implications of modern telecommunications technology. Because the use of this technology in art is the most recent development of the three criteria given by Ascott, it is the least aesthetically explored.

Generally, telematic art has caused us to question the idea of location. Location in telematic art is no longer limited to the specific physical environment, but has now expanded to include remote locations. One important term in this aesthetic exploration of location is "telepresence." Telepresence refers to the ability to "be" in a place other than the physical location in which your body resides.[85] This is possible in some ways through technology, such as the ability to use technology to move equipment located in another place with specificity. For example, a technician can control a deep sea diving machine without being inside of it, while at the same time being able to experience the environment where the machine is located in real time. More commonly, telepresence refers to "presence" in a remote physical location, mostly through the use of projected video and audio.[86] This definition most closely matches telematic art. Because presence has become a more ambiguous concept, artists are able to manipulate this idea for aesthetic purposes. However, perhaps the most important aspect of this ambiguity is the

[85] Lev Manovich, *The Language of New Media,* (Cambridge, Massachusetts: The MIT Press, 2001), 164.
[86] Manovich, *The Language of New Media,* 165.

fact that through telepresence, artists can affect the environment of a specific location without physically being in that location.[87]

Another aesthetic concept brought about through telepresence is that of a simulacrum, a representation of something that is not actually that object. In the case of telematic art, a simulacrum is anything being viewed that is not physically in the same space. Everything still hinges on the perception of the presence of a person who is not physically in the same space. The projection is the simulacrum. However, does it retain the full abilities of a person in the physical space, or is it merely a shadow, a reflection, limited and deficient in some aspects? The introduction of telecommunications technology has raised these questions.

There are also additional aesthetic options to be considered. Each of the other elements of telematic art (the *Gesamtkunstwerk* and audience interaction) offer choices to be made about their use in this art form. The *Gesamtkunstwerk* could be interpreted in a synesthetic sense, or as an equal approach to combining art forms, or with a single art form dominating, while it is buttressed and supported by other art forms. We have seen that an interactive art work can be created in almost any conceivable way, from the overtly and exaggeratedly interactive to the subtle, individual, and unconscious interaction. These aesthetic possibilities are seemingly limitless. However, given the incredible variety of options, it is possible that some are not quite as flexible as they first appear. Eventually, aesthetic possibilities are reduced, at least to the audience, through familiarity. This will ultimately lead to a prescriptive formula for this new artistic genre. For example, in today's society, seeing a movie is no longer exciting and new. There are formulaic prescriptions for interacting with it based on common societal norms. Therefore, the audience loses the perspective to judge the aesthetic choices being made. It does not imply that the choices are not made, but merely that the audience does not consciously relate

[87] Ibid., 167.

to them. This idea is reflected in art over time, as spoken of by Lev Manovich in *The Language of New Media*. In this book, he indicates that initially a new communication technology is seen as disruptive, but later is assimilated into the culture and becomes normal, and no longer worthy of attention as a unique phenomenon.[88] This desensitization is happening and will continue to happen with elements such as video conferencing and the aesthetic issue of telepresence that arises from it in telematic art. The assimilation has already begun and will soon not even be seen as something to be remarked upon. This acclimatization will lead to telematic art becoming commonplace in its technological use, leaving its uniqueness to exist solely within the combination of Ascott's three parameters.

In the end, telematic art is a sum of three ideas, the *Gesamtkunstwerk*, telecommunications, and interactivity. The historical discussion of these individual elements illustrates the groundwork for telematic art, but it does not convey the full meaning. With the incredible globalization the world has experienced due to the Internet, the true point of telematic art begins to become clear. As Ascott predicted, we have become part of a larger, global community, and telematic art is the outgrowth of our ability to share ourselves with each other in newer, simpler, easier ways.

1.7 CONCLUSIONS

A number of foundational concepts have been explored in this chapter; however, many interesting questions remain outside the scope of this paper. Questions such as, what are the boundaries between networked performance and telematic performance? Can telematic art authentically be performed with pre-existing music not created for the telematic genre? What is telematic art's place in the larger art world?

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[88] Manovich, *The Language of New Media,* 170-175.

It is abundantly clear that the most influential thinkers on topics related to telematic art have looked forward to make predictions. Telematic art is a realization of abstract ideas taken from a variety of places and consolidated by these individuals. While much of the reality of both telematic art and society today are not precisely what was envisioned, a significant portion of the predictions made have come to pass. This is particularly true with Ascott and his 1960s vision of globalization. We have achieved a global community that is able to interact with the click of a mouse. While the community is not complete, it is expanding and exists across the world. This has led to, as he hoped, a new culture. Telematic art has a clear philosophical background that prescribes specific elements: integrating art forms, the use of telecommunications technology, and audience interaction. Each of these features has its own unique place in history. The truly exciting thing about telematic art is how all of the disparate elements come together. "Telematic culture means, in short, that we do not think, see, or feel in isolation. Creativity is shared, authorship is distributed…"[89]

[89] Ascott, "Love in the Telematic Embrace," 238.

CHAPTER II: A GUIDE FOR THE BEGINNING TELEMATIC MUSICIAN

While beginning telematic artists have an understanding of their own artistic mediums, they may lack knowledge about the technology required to create telematic art. Therefore, it is important to have a guide outlining essential technological tools, their uses, and attributes to inform artists about these tools. Most entry-level telematic art performers will likely need to learn about some or all of these resources, and just as importantly, how they work. These technological tools consist of both hardware and software, and the technology also requires a basic understanding of the Internet and networking. Further, most people new to the genre will need to be aware of concerns relating to telematic art rehearsal and performance, particularly regarding additional complexities introduced by the use of technology.

Telematic performance is, by its very nature, collaborative. This means that each individual working on a telematic performance needs to have the appropriate technical information. In the case of telematic musicians, they will likely need all of the information discussed above in order to be fully prepared for a rehearsal. Also, the telematic musician must have the correct technological equipment as well as enough familiarity with that equipment to engage in troubleshooting as necessary. This means that the telematic musician, and indeed, any telematic artist, must be proficient in both their art and technology.

2.1 THE COMPUTER

The first tool of telematic art, and the most important of all the technological tools, is the computer. It is the single most important device necessary for telematic art because all other required technologies are connected to or come in contact with the computer. In order to use

current, up to date software, it is vital to have a good quality, reasonably fast computer. Unfortunately, due to constant changes in both computer specifications and requirements for programs, it is impractical to give precise computer system guidelines and specifications. However, it must be able to process information quickly enough that there will be no latency while sending audio and video signals to the Internet. It also must be compatible with the hardware and software that is being used. For example, a typical telematic art performance employs some sort of video conferencing software, possibly some alternate audio software, a fast Internet connection, a video camera, and an audio interface. Although performances could incorporate additional tools, even a simple setup requires these basic elements. As such, the artist's computer must have enough processing power to work with all of these components simultaneously. Depending on the complexity of the setup, a multiple computer array may also be required.

When choosing a computer, it is a necessity to consider its purposes and what programs will be used to allow it to fulfill these goals. These concerns will affect which operating system the computer should have; while many software programs used for telematic art are cross-platform, there are also quite a few that are platform specific. In particular, many products designed by or for the Macintosh operating system cannot be used on other operating systems. There are currently three different major operating systems: Windows, Macintosh, and Linux. Linux has many different options available for customizing the platform. It is an open source system, and it exists in many forms. These characteristics make Linux the most flexible environment of the various operating systems, since it can be adapted to contain either a Windows-like or a Mac-like environment. It is by far the most customizable option, as well as the most difficult. A Linux setup is only recommended for people who are already familiar with

the platform, since it requires the most knowledge and the ability to troubleshoot the operating system. Macintosh and Windows operating systems are much more common, require less knowledge, and have extensive online support resources. For more complex telematic setups it is common to employ multiple computers that may run different operating systems. In this way, operating system specific programs can be used at the same time, which is usually unnecessary and inadvisable for smaller-scale performances. A simpler solution is a better choice whenever possible.

2.2 SOFTWARE

When performing with telematics, there are several essential software elements. These can be combined within a single piece of software, or can exist on their own in separate programs. The elements are audio and video capturing, transmission, and synchronization. Depending on the type of software being used, the audio and video categories may be managed by a single program, or they may require separate applications. At this time, many different and new types of software are being developed for telematics use. While some reside in the public domain, many are still privately developed and used by people involved in the field, resulting in some difficulty obtaining the software or being able to use it freely. The complexity of each individual performance will dictate software requirements, as the capabilities of each program differ greatly.

2.3 VIDEO

One element to consider when planning a telematic performance is video transmission, which hinges upon today's video conferencing software and/or Voice Over Internet Protocol

(VOIP) software. Video conferencing was originally designed as a way of projecting both a video and audio feed over the Internet with minimal delay to communicate directly with another person; it is ubiquitous today. Some well-known examples include Skype, Google VideoChat, and others. VOIPs can be considered as older versions of the same platforms. VOIPs allow users to transmit sound alone without video. Some commonly used programs, often employed by the video game community in Massively Multiplayer Online Role Playing Games (MMORPGs), are Ventrilo, TeamSpeak, and Mumble. However, since video conferencing and VOIP applications may not be optimized for high quality audio transmission, they are not necessarily desirable options for use in telematic performance. Some issues that may occur while using these programs include the inability to: determine audio quality, send uncompressed or high quality audio, determine audio and video compression rates, and ensure audio and video synchronization.

For transmitting video there are several options. These include programs such as ConferenceXP, vipr, Skype, and other video conferencing services. Among these offerings, some have higher quality than others. Most general video conferencing services, like Skype, are designed for a common user experience which takes many choices out of the users' hands in order to make the program easy to use. This creates a real problem for the telematic artist because the software has numerous limitations in terms of video quality, synchronization, and audio quality. Due to these limitations, Skype is not generally a good choice for use in telematic music, and if employed, is likely to only be used for its video purposes. Even for strictly visual purposes, Skype is a poor choice when there are higher quality options available. Video quality

in telematic art is important.[90] Telematic art involves multiple senses, and there is no reason for one to be ignored, particularly when poor video quality can lead to distraction.

One of the best choices for video transmission is Microsoft's ConferenceXP because it allows for high quality video signal.[91] It is not, however, without limitations; ConferenceXP is only available on the Windows platform and is not frequently updated.[92] Most other recommended software is Macintosh based, and therefore is not compatible with the Windows operating system. When using more than one software program that require different operating systems you must use more than one computer, which leads to running both Macintosh and Windows operating systems, which can create difficulty for some users. ConferenceXP has many positives, though; in particular, users can configure most of the video settings including selecting which camera to use, determining video frame compression rates, and choosing how the video looks on the user's screen (See Fig. 2.1 below).[93] ConferenceXP supports either an on-board webcam or cameras attached to the computer via a USB port. With the latter's solution, performers can use high quality video cameras that are significantly better than most webcams. ConferenceXP's video and audio transmission is accomplished by joining a "venue" (similar to a virtual chat room) where video and audio feeds as well as many other types of media can be displayed. The transmitted video would then appear as a projection from ConferenceXP at the performance space.

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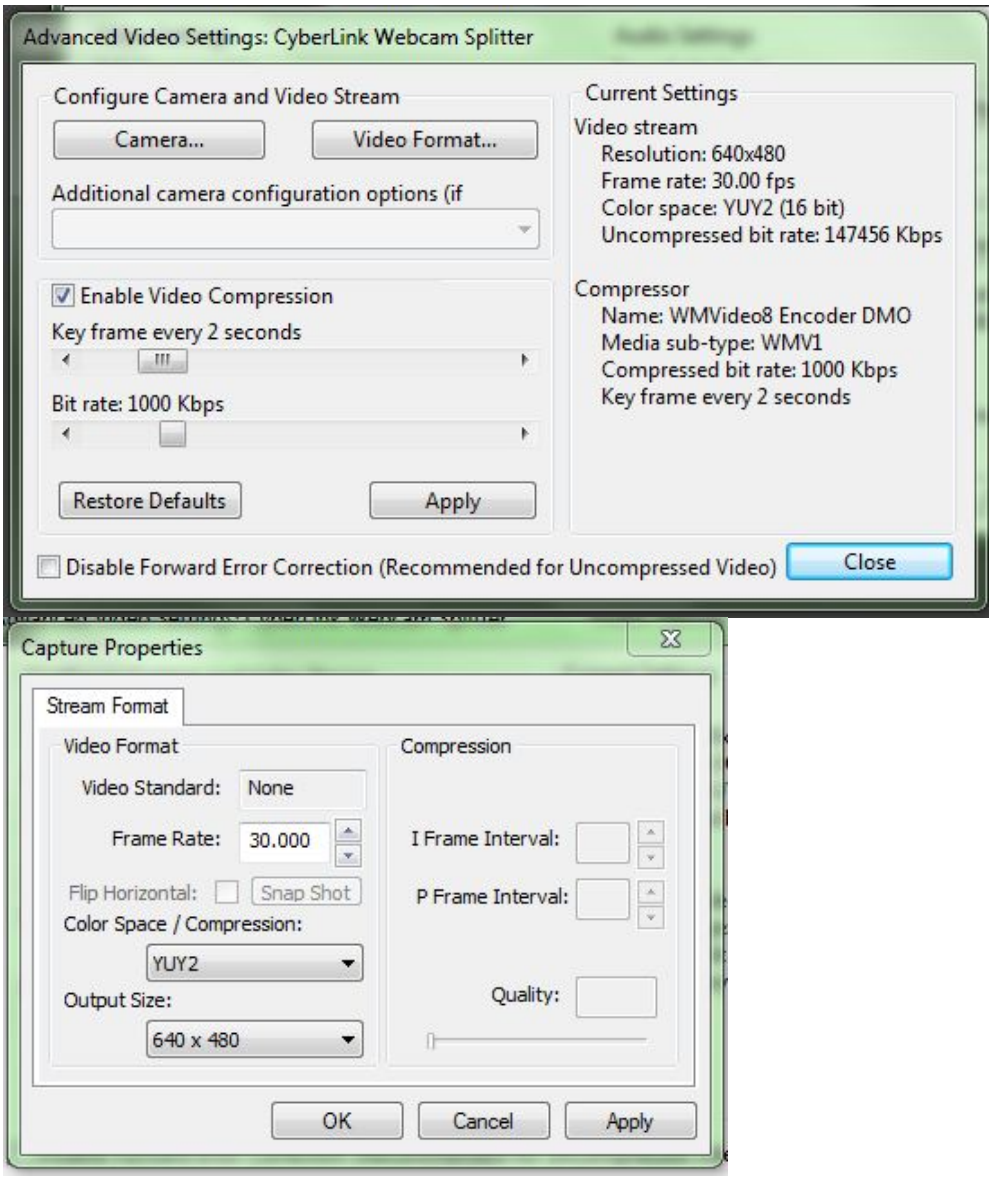
[90] Scott Deal, an interview by Mark Cook, (Indianapolis, IN), November 2013.
[91] Deal, Interview.
[92] Ibid.
[93] More documentation about ConferenceXP is available through this wiki: http://cct.cs.washington.edu/project-wiki/index.php/ConferenceXP_Wiki

Figure 2.1: ConferenceXP Video Settings. *Above*, advanced video settings; *below,* video capture properties.



The software application vipr (video image processing and relay) is a newer high quality tool.[94] Vipr is a video transmission application created by Benjamin Smith, an assistant professor at Indiana University – Purdue University Indianapolis (IUPUI). Vipr is capable of running on

[94] Benjamin Smith, "vipr," (accessed September 23, 2014), http://ben.musicsmiths.us/vipr.phtml.

either a Windows or Macintosh operating system. Vipr was created using Max/MSP, a common tool for composers and musicians who work with electronics. Max/MSP is a very flexible platform that works as a visual programming language and can be used for audio and video manipulation, and in this case, video transmission. In order to use vipr, the user must download a set of platform-specific tools along with the program called externals. Vipr currently consists of two distinct programs, one each that sends and receives video. Vipr transmits video data only via Internet[95] and allows users to input specific IP addresses and customize video bit rates and frame rates (see Fig. 2.2). Vipr is not as easy to use as ConferenceXP, but it is not significantly more difficult. Either of these two options are ideal choices for video transmission because of their features and flexibility. In addition, they are currently both freely available on the Internet. ConferenceXP is an open-source platform that is run by the University of Washington, and vipr is available through Benjamin Smith's website.

[95] More information about supported codecs for vipr is available here: http://ben.musicsmiths.us/vipr.phtml.

Figure 2.2: vipr Video Transmitter

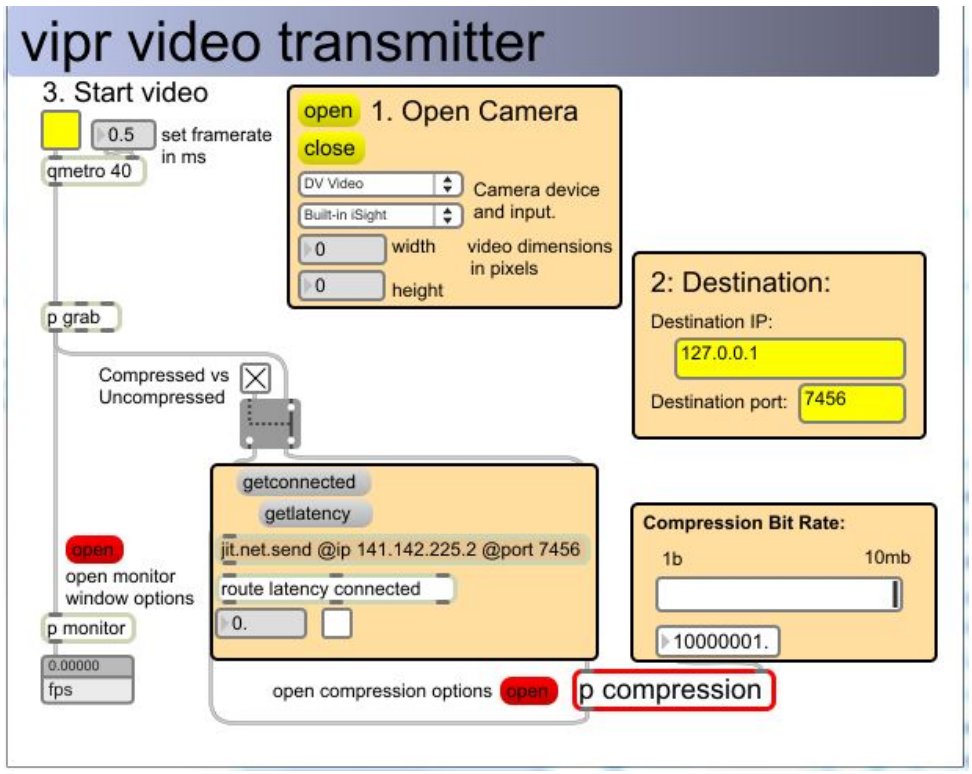
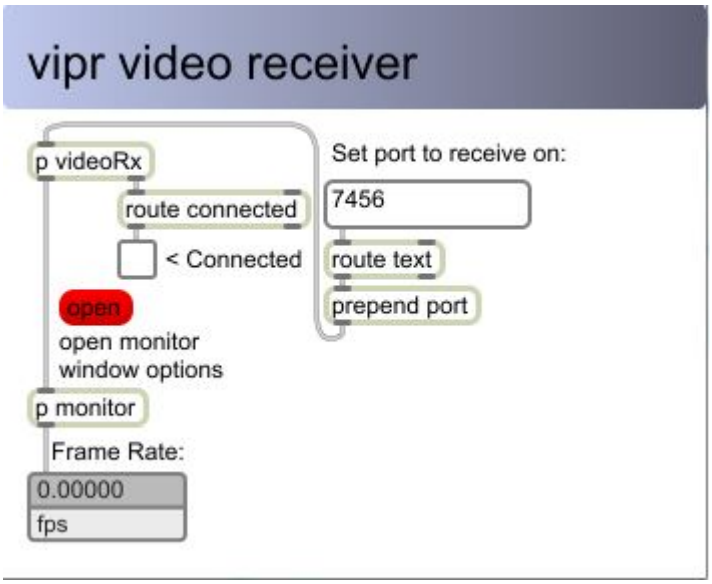


Figure 2.3: vipr Video Receiver

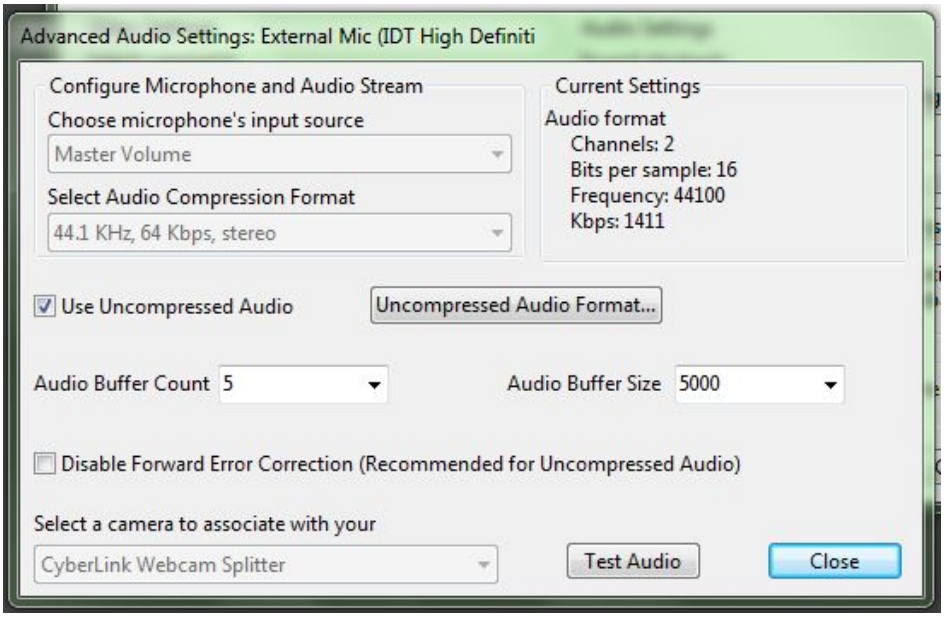


2.4 AUDIO

There are many audio-only possibilities for the telematic artist as well, and they differ significantly in quality and options. Specific software options include Skype, ConferenceXP, and JackTrip. The greatest difference between these software applications is the ability to determine audio compression rate, the number of audio channels, and CPU prioritization. Overall, Skype is definitely the worst audio option. Again, since Skype is a consumer-driven video conferencing application, the software automatically configures and controls many options that are customizable in other programs. Skype's most concerning aspect is its inability to allow for control of audio compression rates, or the degree to which sound is compressed before it is sent over the Internet. High audio compression reduces sound quality and can very easily lead to sonic artifacts, or unwanted sonic material. Also, Skype does not allow the user to control how many audio channels are being sent. However, Skype is important to mention because telematic artists need to be aware of the limitations of widely-available software. They must be able to create a high quality product, which cannot necessarily be produced using tools that are not specifically designed for the task.

ConferenceXP is all-in-one software that allows for simultaneous video and audio transmission. It is exceptional in that it offers complete control of audio quality and allows the user to set the audio compression level, even to the point of allowing completely uncompressed audio (see Fig. 2.4). Completely uncompressed audio is very important for the telematic musician because any sort of compression can cause artifacts in the sound. ConferenceXP's shortcoming is supporting transmission of only two audio channels. This limitation can be very restrictive depending on the complexity of the setup and the desired output.

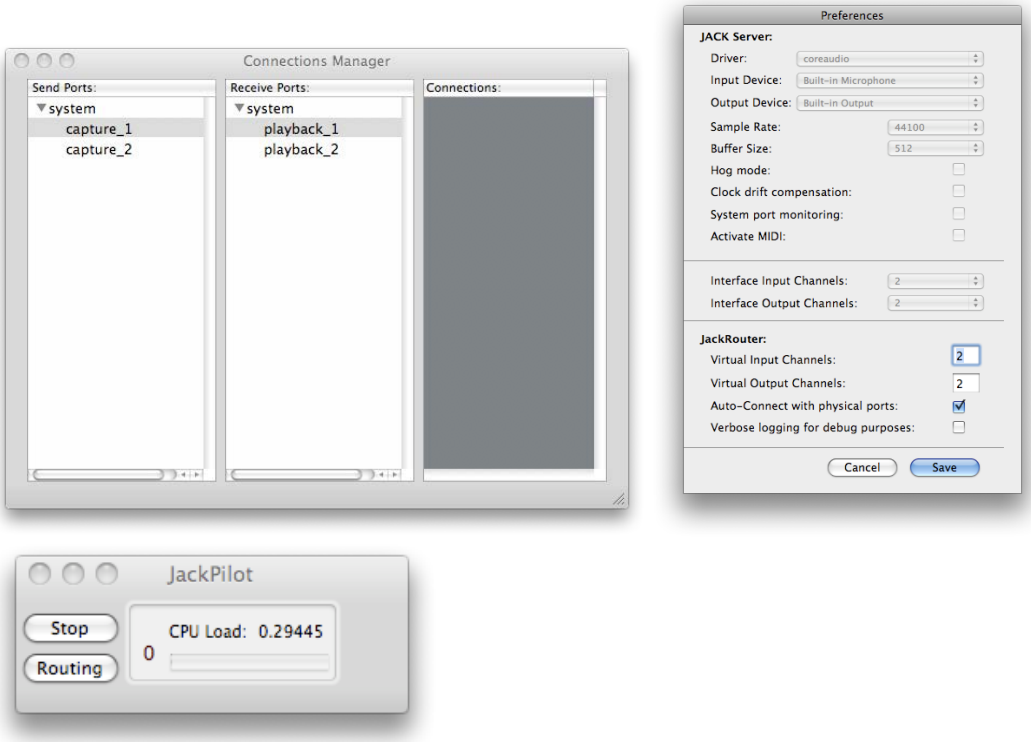
Figure 2.4: ConferenceXP Audio Settings



The other specific piece of audio software is JackTrip.[96] JackTrip is intended for routing many channels of high quality audio between multiple machines. It is currently the only software that works exceptionally well for multi-site, multi-channel audio. It supports the transmission of 16-bit audio over the Internet.[97] This software is specially designed to eliminate latency (the delay between cause and effect, in this case, the length of time between the program trying to send audio, and when the audio actually sends) by bypassing most processes within the computer, which allows audio to move more quickly. JackTrip is the most important application in the digital sound arena for transmitting and receiving sound.[98] JackTrip is currently only available for the Macintosh platform.

[96] Further documentation of JackTrip is available as part of the download of the program.
[97] Deal, Interview.
[98] Ibid.

Figure 2.5: JackTrip images. *Above left*, Connections Manager; *above right*, Audio Preferences; *below*, JackPilot (allows control and routing).



2.5 SOFTWARE RECOMMENDATIONS

The most important consideration for software recommendations is that the setup should be as simple as possible. This does not imply that all technical setups will be simple. If, for example, twelve different audio channels are necessary, JackTrip should be the software of choice. If a setup requires seven laptops, use them. But when possible, limit the number of components. For a simple telematic setup that requires only two channels of audio, ConferenceXP is recommended.[99] While it is a Windows-based program, it is also self-contained and does not require other applications to be used in concert with it. Alternately, if this is not

[99] Deal, Interview.

possible, using vipr and JackTrip is recommended.[100] While this uses two programs, they both can be run simultaneously on a Macintosh laptop, limiting the necessary hardware. Additionally, any performance that requires more than two channels of audio should use JackTrip.

Figure 2.6: Software Recommendations.

Performance Scenario	**Recommended Video Software**	**Recommended Audio Software**
Performance with 2-channel audio (Windows)	ConferenceXP	ConferenceXP
Performance with 2-channel audio (Macintosh)	vipr	JackTrip
Performance with multiple channels (more than 2) of audio	vipr	JackTrip
Complex performance (involving multiple computers and audio and video streams)	vipr	JackTrip

2.6 HARDWARE

The other tools for performing telematically are all hardware based. These include at minimum an audio interface, microphone, video camera, and cables. More options include a mixer and a sound system. The audio pieces function together in this way: a microphone receives the sound, the audio is sent into the audio interface which converts the analog signal into a digital signal and sends that on to the computer. The video pieces function this way: the video camera receives the video, and the video is sent from the camera into the computer. From the computer, the audio and video are synced inside the video conferencing software application and then transmitted via Internet to the remote location. On the other end, the audio signal is received, routed to another audio interface for conversion back to an analog signal, and then sent to a

[100] Ibid.

sound system, either directly or via a mixer. The video signal is shown in real-time, usually through a video projector or video screen.

Figure 2.7: *Left*, video signal flow from the musician; *right,* audio signal flow from the musician.

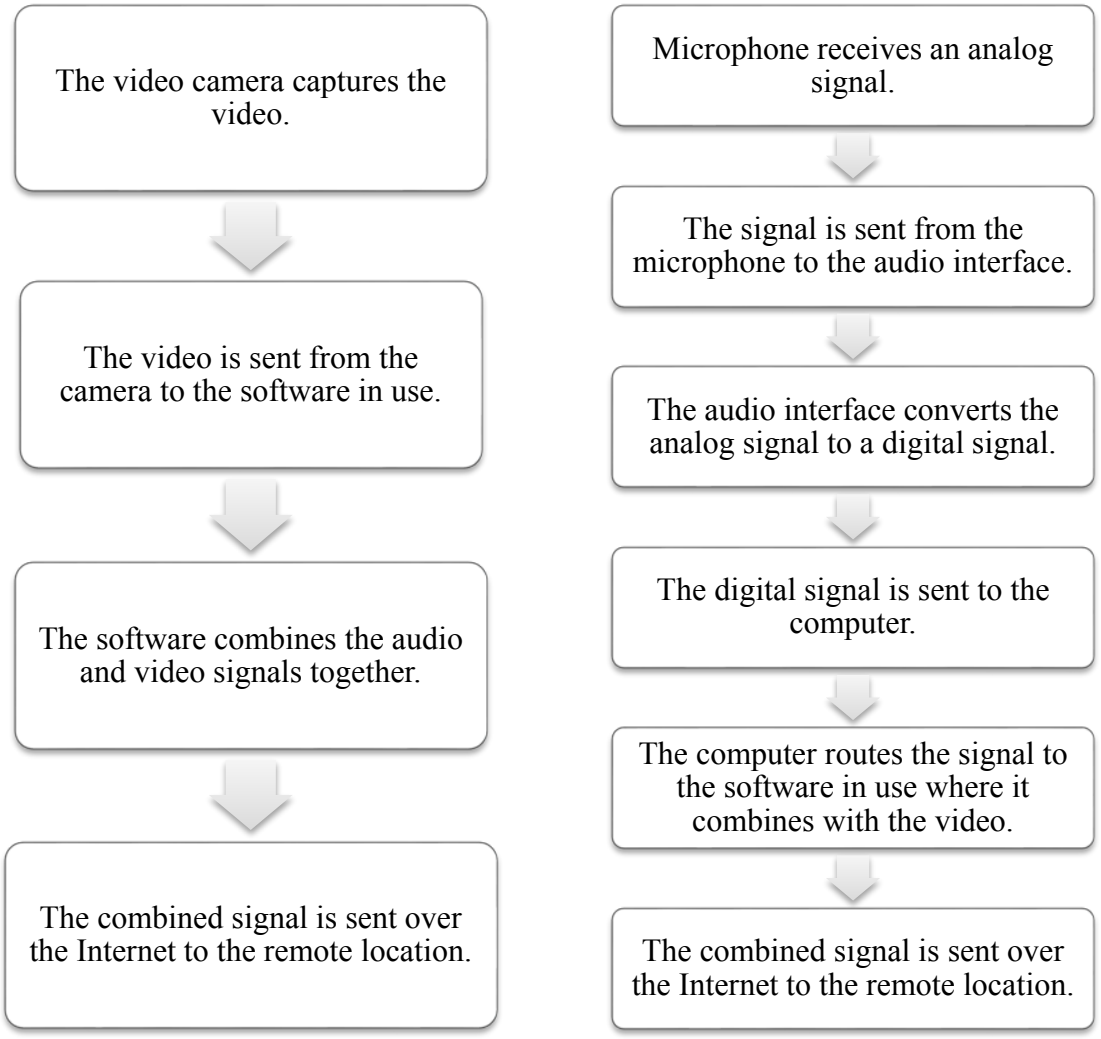
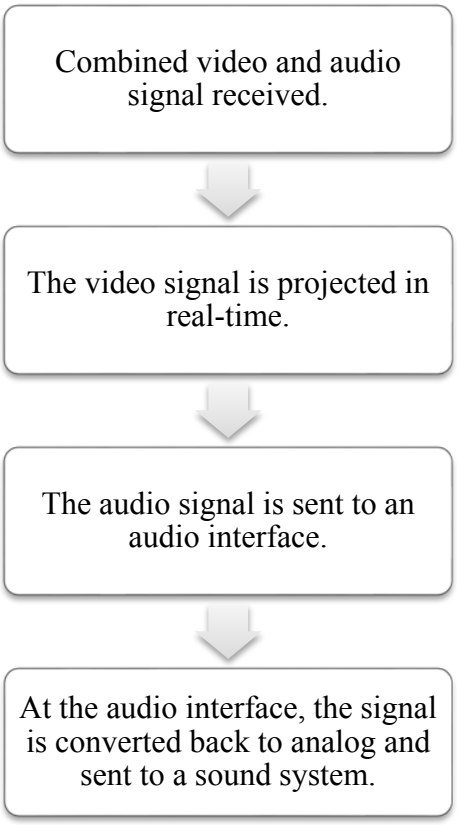


Figure 2.8: Signal Flow at Performance Venue.



The next item to consider is the microphone. Microphones are an incredibly substantial topic, and there are countless options and varieties. There are four primary microphone construction types: dynamic, condenser, ribbon, and electret-condenser microphones.[101] They all serve different purposes, and may or may not be right for different instruments. Dynamic microphones are very rugged microphones that typically have high sound pressure levels (SPLs) and are a good choice for very loud instruments. An SPL is the ratio between the actual sound pressure and fixed reference pressure, and is measured in decibels. In practical terms when a sound is too loud, generating too high of an SPL for a specific microphone, then it will cause the sound to distort. Condenser microphones have a very flat response and can be considered more

[101] Huber and Runstein, *Modern Recording Techniques*, (Burlington: Elsevier, 2010), Chapter 4.

life-like in the way they pick up sound. They have lower SPLs and are more sensitive to sound. They will do a better job of picking up short attacks clearly and have a wider dynamic range than dynamic microphones. Condenser microphones come in large, medium, and small diaphragm options, which somewhat correspond with register; low registers needing large diaphragms, and high registers needing small diaphragms. All condenser microphones require phantom power. Ribbon microphones operate on the same principles as dynamic microphones but have a very distinct sound. They are somewhat fragile in contrast to the dynamic microphones, and some require phantom power. The ribbon microphone was very popular several decades ago but fell out of favor. They are now making a comeback and being updated with new technology.[102] Electret-condenser microphones are commonly used in cell phones and many other small devices.[103] They typically do not have the same quality as microphones designed specifically for high-end performance.

Condenser microphones are a good choice for most performance needs, as they feature high quality, accurate sound reproduction, and a quick response leading to more precise reproduction of attacks and transients, as well as a flatter frequency response. They also require phantom power and have a lower SPL rating than other microphones. My own microphone collection includes a dynamic microphone, a large diaphragm condenser, and a stereo pair of small-diaphragm condensers. This assortment of microphones provides a range of options for amplifying and recording percussion and works well for most scenarios, unless I plan on playing extremely large setups. It is important to get a microphone that meets the specific needs of the instrument and the scenario. However, as a default, it is often appropriate to select a condenser microphone.

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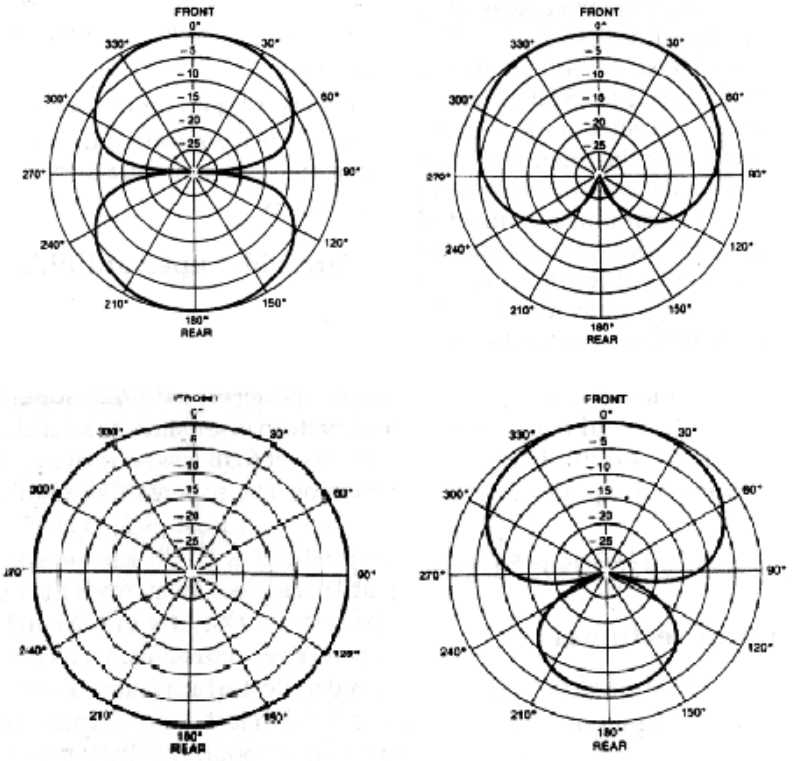
[102] Huber and Runstein, Chapter 4.
[103] Ibid.

The final consideration for microphones is their polar pattern. Microphones can be directional, bidirectional, or omnidirectional (see Fig. 2.10). Today's directional microphones are mostly cardioid, which means they sense sound directly out in front of them, but also partially on the sides. Supercardioid microphones include the ability to sense a small amount of audio from directly behind as well. Bidirectional microphone polar patterns look like figure eights; they "hear" in two directions at once. Omnidirectional microphones have a circular polar pattern and pick up signal in all directions (360-degrees.)

Figure 2.9: Microphone Polar Patterns. *Above left,* bidirectional polar pattern; *above right,* cardioid polar pattern; *below left,* omnidirectional polar pattern; *below right*, supercardioid polar pattern.[104]

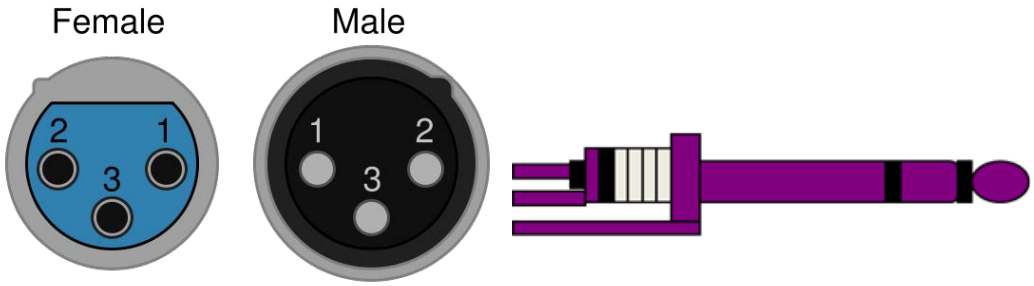


An audio interface is a mandatory tool for high quality telematic music production, and high quality digital audio in general. Performers must be able to convert their signals from analog to digital in order to send them over the Internet. While some audio mixers include built-in interfaces, it is advisable to have a discrete one. The audio interface should have at least two microphone inputs and stereo output. Preferably, the microphone inputs should be XLR compatible, as well as quarter inch Tip, Ring, Sleeve (TRS) compatible. Both XLR and TRS refer to specific connection types (see Fig. 2.11). An XLR cable is a standard balanced microphone cable, and a quarter inch TRS is a standard balanced audio cable. The audio

[104] Bunce, "Recording Techniques," 14.

interface outputs should be balanced outputs as well, typically TRS outputs, but XLR outputs are also acceptable. One other common audio connection to be mentioned is an RCA connection. This connection type is common on some lower end audio equipment. RCA connections are functional; however, they are also unbalanced, and therefore not advisable due to a decrease in overall sound quality. Additionally, it is very important that the inputs have trim controls for volume adjustment, and they should also have phantom power. Phantom power is a way of transmitting additional power (DC +48V) through a microphone cable in order to be able to use condenser microphones. Simply put, it gives the player more microphone options. The inputs on an audio interface should be able to function either as discrete mono channels or as stereo channels. Other features to look for when purchasing an audio interface include how it connects to the computer and how it is powered. Current standard computer connections are USB, Firewire, or Thunderbolt. Many interfaces can be bus powered (powered through their connections to the computer) but some larger ones require discrete power supplies. An audio interface is more likely to need discrete power if it supports phantom power, though discrete power is by no means mandatory.

Figure 2.10: XLR and TRS Connections. *Left,* XLR; *right,* TRS.[105]



[105] Mark Bunce, "Recording Techniques MUCT 436/586 Study Guide," Class Handout, Bowling Green State University, Bowling Green, OH, August 2012, 10.

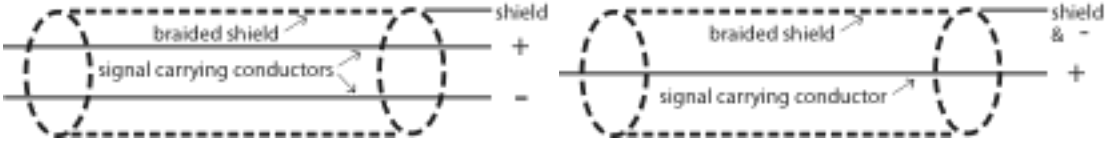
Figure 2.11: Sample Audio Interface inputs. *Top*, back side; *bottom*, front side.

Finally on the list of tools for the telematic performer are cables. It is crucial to consider how all of the high quality audio equipment is connected. Cables vary in quality by types of materials used in two ways: noise and life span. In a poorly made cable, or one made of poor materials, the inferior cable quality is likely to generate noise by itself. This noise typically results from improper shielding between the cable's positive, negative, and ground wires. Lower quality cables also are more prone to breakage and must be handled more carefully. Something as simple as bending a cable can cause a short inside the cable, and it is much more likely to happen to a cheap cable. To avoid this problem, it is preferable to invest in high quality cables.

Another important consideration with cables and audio interfaces is the inputs and outputs, and whether they are balanced or unbalanced (see Fig. 2.13). A balanced input has three separate points of contact for each of the three parts of any electrical line: a positive, a negative,

and a ground. In contrast, an unbalanced input has two points of contact: a positive and a combined negative and ground. Generally, unbalanced inputs create extra noise, especially with longer cables. With anything exceeding six feet, a balanced cable will gather less noise. Certainly if the line is being run next to a power cord, it is preferable to avoid unbalanced connections. In an unbalanced cable, the positive line is run on the inside with a shield around it, which actually contains the negative and ground line. This means that the shield will pick up extra noise that is then transmitted along with the signal. Basically, both cable types will pick up extra noise, but because it will be picked up equally in a balanced cable, between the positive and negative, it will end up cancelling itself out, thus creating a quieter cable. Examples of balanced audio connections are TRS and XLR cables.

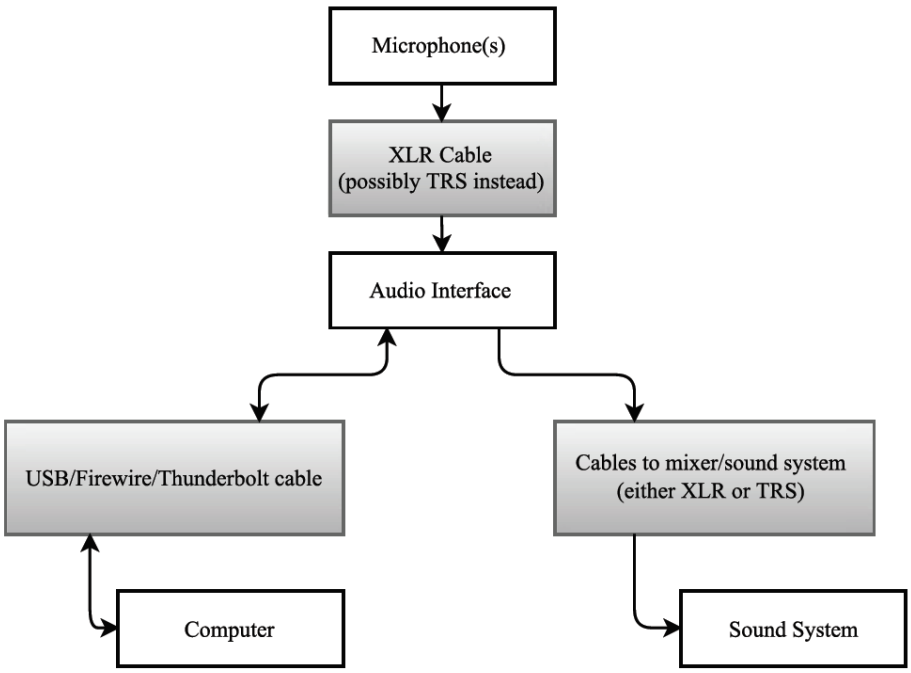
Figure 2.12: Balanced and Unbalanced Cable Diagram. *Left,* Balanced Cable; *right*, Unbalanced cable.[106]



Different cables are used for different purposes, based on the connections they use. XLR cables are most commonly used for microphones, but at times are used to connect the sound system to an audio interface, or a mixer. TRS connections are commonly used to connect to the sound system, and can also be used for line inputs. In some cases, they are also used to connect to microphones as well.

[106] Bunce, "Recording Techniques," 9.

Figure 2.13: Cable setup



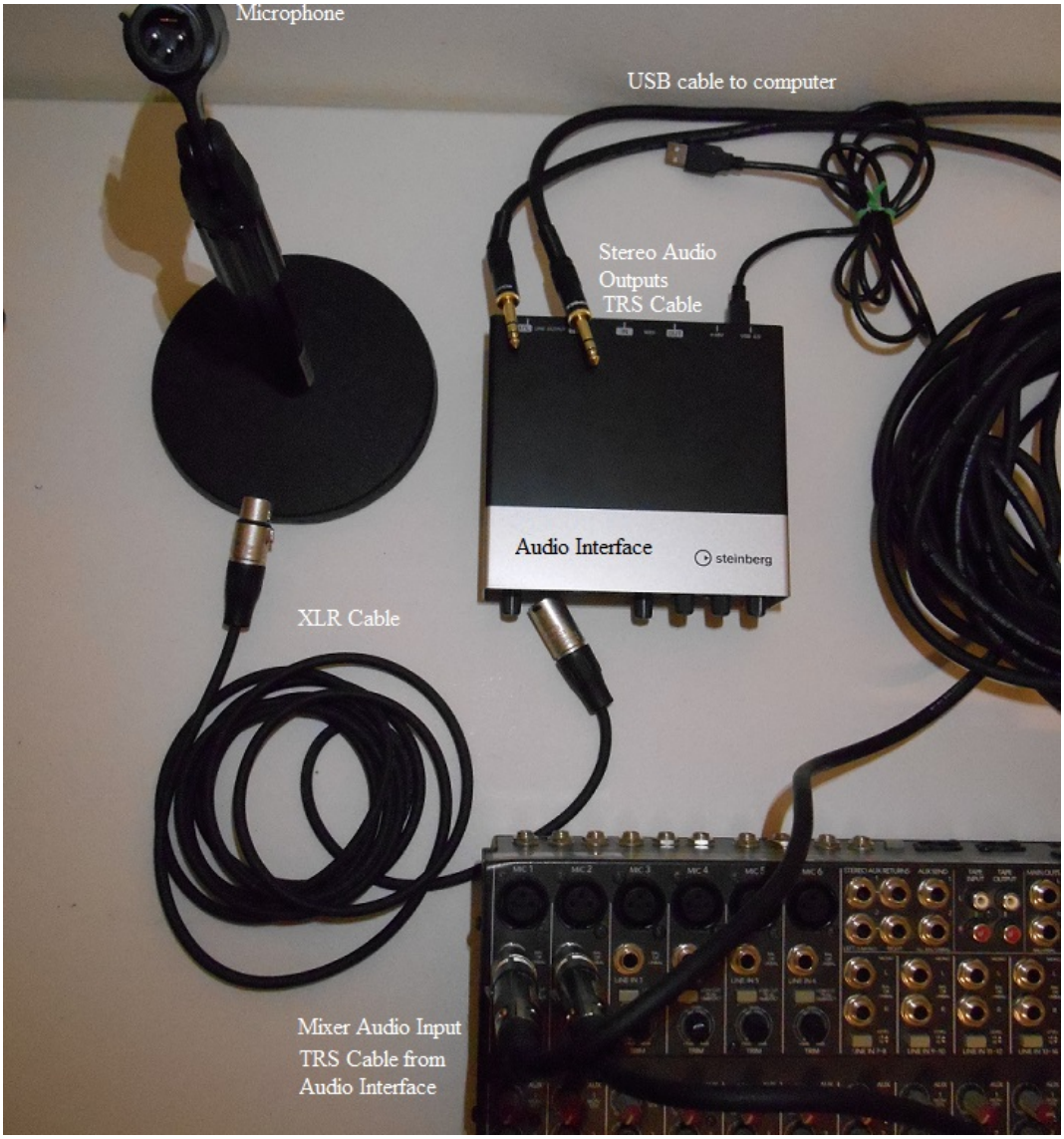
2.7 TECHNICAL EQUIPMENT SETUP

After all the equipment is acquired, it is time to set it up. The individual pieces of technology that have to be connected are the microphone(s), the audio interface and the computer. The microphone will need to be connected to the audio interface using (in most cases) an XLR cable. The female end will plug into the microphone and the male end will plug into the audio interface. Take into account the ideal distance between the audio interface and the microphone when choosing this cable in order to determine the proper length. The ideal distance will vary by location, but in general a longer cable is likely to be more practical than a shorter one because it will be usable in more situations. The audio interface will also have to be connected to the computer. This will be done via its specific connection type: either USB, Firewire, or Thunderbolt.

The relative areas where the equipment is set up will also vary based on the circumstances, but there are some general rules. The microphone(s) will be located near the instrument, or the performance location within the venue. This location may be some distance from the audio interface and the computer. When this setup location has an audience in attendance, it is more likely for the microphone to be some distance from the computer and audio interface. For example, in this case it is likely that the microphone and performer will be on stage while the audio interface and computer are not. The audio interface may be placed on the stage near the performer if necessary for the comfort of the performer or the demands of the performance. Either way, always remember to consider the length of cables that are accessible. In any situation where there is an audio technician to help the performer with the technical elements, it is likely that the audio interface and computer will be off-stage. Similarly, the computer may be placed either by the performer or off-stage as well. In many cases the computer and audio interface will be next to each other, offering the audio technician (or the performer) all of the available options for controlling the sound in one location. This arrangement will reduce the possibilities of adjustments needing to occur in more than one location, which will simplify the performance.

One final consideration is that there may be a difference between the practice and performance setups. Initially in the practice phase, the equipment should be kept easily accessible for instant and frequent adjustments to be made until the equipment is working as desired. After this has been achieved, the equipment may not need to be as accessible and can be moved if necessary.

Figure 2.14: Picture of sample audio setup.



2.8 SYNCHRONIZATION

Synchronization, or syncing, which refers to intentionally conjoining features of a telematic performance, exists as an element of telematic art. The elements that are most involved in this process are audio and video synchronization within each individual venue, and audio and video synchronization between the venues.

Synchronization is an important issue to consider in the planning and execution of telematic music. The major technological issue that can arise is video and audio syncing concerns. An audio/video (a/v) sync issue occurs when video and audio streams are not temporally aligned. This can happen due to any number of complications, including differences in processing times, lack of a/v syncing protocols inside a program, using multiple pieces of unrelated equipment, or even through large distances between the performer and microphone. According to the Advanced Television Systems Committee (ATSC), the acceptable window for syncing audio to video is -30ms to +22.5ms.[107] This is actually a large time span, since it is possible to perceive a synchronization gap significantly smaller than thirty milliseconds.

To reduce the likelihood of synchronization issues, check video and audio stream rates during setup. For example, if the video stream is approximately 10Mbps, and the audio stream is 1Mbps, the audio stream will arrive more quickly than the video. This is not necessarily due to the network, though it can be related, but may also be caused by the computer's processing speed. If the computer takes significantly longer to process video, visual latency will occur unless there is a syncing protocol built into the program in use.[108]

Another common cause for synchronization problems is using unrelated equipment. Due to technological advances, this problem is not common. Using a microphone for audio input that is separate from the video input can cause problems syncing the two streams. A solution for this problem is to use one piece of equipment (just a video camera) that incorporates both video and audio, or run the audio into the video camera before it all goes to the computer.

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[107] Waddel, Jones, and Goldberg, "Audio/Video Synchronization Standards and Solutions A Status Report," (Accessed December 7, 2012), http://www.atsc.org/cms/pdf/audio_seminar/12, 11.
[108] Cugini, Aldo, "Correcting lip sync errors," (accessed December 7, 2012), http://broadcastengineering.com/video-t-amp-m/correcting-lip-sync-errors.

Synchronization exists outside of the technical realm as well. One aspect of synchronization is the ability of people to play very quick complex passages together in real-time, demanding very low latency between audio channels. This is possible depending on adequate bandwidth. It requires a different level of synchronization than a piece that only demands that it last approximately eight minutes without complex rhythmic passages. A second aspect is syncing multiple locations to a master clock so that large scale, timing-dependent works can occur as designated in a synchronized real-time.

There are multiple options for synchronization between people in remote locations. These possibilities seem to change frequently as people find various solutions to perform with each other. Some of these solutions involve music that is not designed to be performed in exact synchronicity. Other options include sending a discrete or separate metronome/click track audio channel to synchronize a remote location to a "master" location. There are also some specific software applications that can help. Many of these software applications such as Backstage (which is discussed below) are privately developed, and do not exist in a free form on the Internet, or are not available for public use. This is an unfortunate but understandable issue, which has the potential to change in the future. Unlike video conferencing and audio routing software, the exact synchronization of an internal clock for use by people in multiple locations is not necessarily highly marketable, which limits development. In many cases these software applications are not necessary for telematic performance, as they are designed for use with large and complex performances.

One example of a master sychronization software application is Backstage, web-based software developed by Dr. Chulyuan Meng, a professor at IUPUI. In a telematic performance, this program coordinates the logistical elements of performing with people in multiple locations.

Essentially it includes two versions of a timer: a countdown and a master clock. The timers can be set with multiple instances, allowing for multiple synchronization points. It is intended for one computer to exist as a master, with other devices being slaves to it. The master device forces the clocks of each device connected to it to synchronize when the program is armed. Because every device has its own internal time, they will eventually drift apart after the initial start point, but the synchronization is forced through the devices at regular, short intervals in order to ensure that the clock remains consistent between all the devices. This is an ideal way to guarantee synchronization between many performers who have time cues in their music. It gives one person control over the clock by allowing them to arm and start the clock and allows the logistics to be dealt with in real-time. Backstage also offers a chat function, where people on the website are able to talk silently, which is excellent for solving logistical problems in real-time in a sound-based performance.

2.9 DATA COMPRESSION

High quality audio and video feeds, or streams, are typically necessary for telematic performance. The most important technological ability for a telematic performer to have is to be able to manipulate audio and video compression rates ranging from uncompressed to extremely compressed. However, while flexibility in compression rates is necessary, it is imperative for a telematic musician to be able to send uncompressed audio across the network, allowing for good sound, and preventing the data compression from causing digital noise. This is relatively easy today, as most networks have enough available bandwidth for at least a single audio channel.[109]

[109] After doing a test on the network speed at Bowling Green State University using www.speedtest.net, the upload speed is 10.23 Mbps, approximately seven times as much speed as is needed for stereo audio transmission. However, BGSU is a member of Internet2, which allows for significantly higher speed as discussed later in the chapter.

Transmitting CD quality stereo (two-channel) audio, typically considered lossless audio, takes 1411 kbps which is 1.4 Mbps.[110] [111] This comparatively small amount of data is helpful because the remaining bandwidth can be taken up by any video being transmitted. In comparison with video files, an audio stream is incredibly small. A 640x480 video at 24 frames per second (fps) uncompressed runs at 22 Mbps.[112] This amount of data is likely too much for most connections, so compression is often required. However, the compression rate should be as low as possible, enabling a better quality video. In a real world application of either ConferenceXP or vipr, compression rates should be fairly simple to control. In both programs, there is a slider for compression, and both the video and audio quality are very easy to determine in a telematic setting. These settings can immediately be checked by the person on the other end of the telecommunications software by simply watching and listening to the live stream.

A discussion of high quality video and audio inevitably turns to details of compression. First of all, when sending uncompressed audio or video, there is no real consideration of codecs (programs that compress or decompress data) beyond initial software settings. In uncompressed audio, it is typical to choose a sampling rate and bit rate. In contrast, for compressed audio, it is necessary to choose a codec to compress the audio. Many different compression options exist, but they fall into two primary categories: lossy and lossless. Lossy compression is so named because it loses some of the file's data during compression to create smaller file sizes. When the data is read, the lost data is typically replaced using a predictive algorithm to fill in the gaps. The most well-known example of lossy formatting is the MP3. Lossless compression, on the other

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[110] JISC Digital Media, "Uncompressed Audio File Formats," (Accessed December 8, 2012,) http://www.jiscdigitalmedia.ac.uk/audio/advice/uncompressed-audio-file-formats.

[111] The speed that the audio will require can also be found in the settings of ConferenceXP when using uncompressed audio.

[112] Forret, "Video Bitrate Calculator," (accessed December 6, 2012), http://web.forret.com/tools/video_fps.asp?width=1280&height=720&fps=24&space=rgb444&depth=8.

hand, includes an instruction set in the file with specifics on how to recreate the original data. Some typical examples of this format include Audio Interchange File Format (AIFF) and Waveform Audio File Format (WAV).[113] It is important to realize that in a digital world, all files are transmitted in binary code, measured in groups of 0s and 1s. Typically when performing telematically, the technology is more concerned with sample and bit rates than codecs, so codecs should not normally be a significant issue.

Internet-based video transmission is a little more difficult, as there are no real standards for uncompressed video, and video files can contain different types of codecs, making it more difficult to know when a file is compressed with a lossy or lossless format.[114] Luckily, the concern will not likely be choosing a video codec but choosing a compression and frame rate. In my experience, it is far more important to have a good frame rate than high resolution, though each needs to be considered. The resolution must be high enough that the picture is decent, but without a good frame rate, the video will not be watchable. Frame rates are more important in faster moving video, as they allow the motion to be seen. In a fairly static video, a slower frame rate can be viewed without being considered unwatchable. A typical frame rate would be at least 24 fps, or somewhat higher at 30.

2.10 INTERNET SPEED

The final key to performing music telematically is the availability of a high-speed network. Internet access is widely available and can be obtained at different speeds. These speeds are available at varying price points determined by Internet service providers. Speed

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[113] Reddy, Mike, "Video Encoding & Decoding for Dummies. Part III—Compression," (Accessed December 8, 2012), http://info.vela.com/Digital-Video-Applications-blog/bid/73738/Video-Encoding-Decoding-for-Dummies-Part-III-Compression.

[114] Reddy, "Video Encoding & Decoding."

options and connection methods vary greatly and range from dial up connections using telephone lines, to cable, satellite, DSL, Google fiber, and even mobile hot spots. The important feature of these networks in relation to telematic music is their speed. As previously discussed, the average telematic performance requires significant bandwidth for every performer to transmit data. The most crucial technical element to a telematic performance success is upload speed. While most people are concerned with download speed, a performer's ability to send/upload data is more crucial because upload speeds are normally significantly slower. In most locations, it is simple to obtain an Internet download speed of 10-15 Mbps or even much faster/higher speeds; it just costs more money. At the same time, it is difficult to exceed a 1 Mbps upload speed. It is essential to realize that most network availability is location based, and large metropolitan areas tend to have more options, but also more people on the network, leading to higher possible speeds, but lower actual connection speeds. Dr. Scott Deal, Professor of Music and Director of the Donald Tavel Arts Technology Research Center at IUPUI, recommends a 100-megabit download speed and a minimum 20-megabit upload speed.[115] These speeds are difficult to obtain, but they allow for real-time transmission of high quality data without latency concerns.

There is one simple solution to network speed, provided a performer or institution has access to it: Internet2, which is "...a member-owned advanced technology community founded by the nation's leading higher education institutions."[116] This high-speed network is available at many institutions of higher learning in the United States as well as at certain businesses.[117] It is capable of much higher speeds than most other networks.

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[115] Deal, Interview.
[116] Internet 2, "About Internet2," (accessed December 7, 2012), http://Internet2.edu/resources/AboutInternet2.pdf.
[117] To check and see if there is a local university or business with access to this network, you can visit the Internet2 website.

When using Internet2, it is also possible to reserve a high-speed point to point data connection in advance. Reserving this connection can allow for incredibly fast data transmissions of up to ten gigabytes per second.[118] Normal traffic over the Internet involves a significant number of stops between one point and another. For example, an email sent from California to New York may be routed through multiple locations before reaching its destination.[119] This routing slows down data transmission because of the distance it crosses, which prevents the near instantaneous speeds made possible with a reserved Internet2 connection. Unfortunately, obtaining these connections can be difficult and costly.[120] Still, the existence of Internet2 is very valuable and allows for much faster transmission speeds than were previously available, which has helped expand the genre of telematic art.

2.11 PREPARING A TELEMATIC PIECE

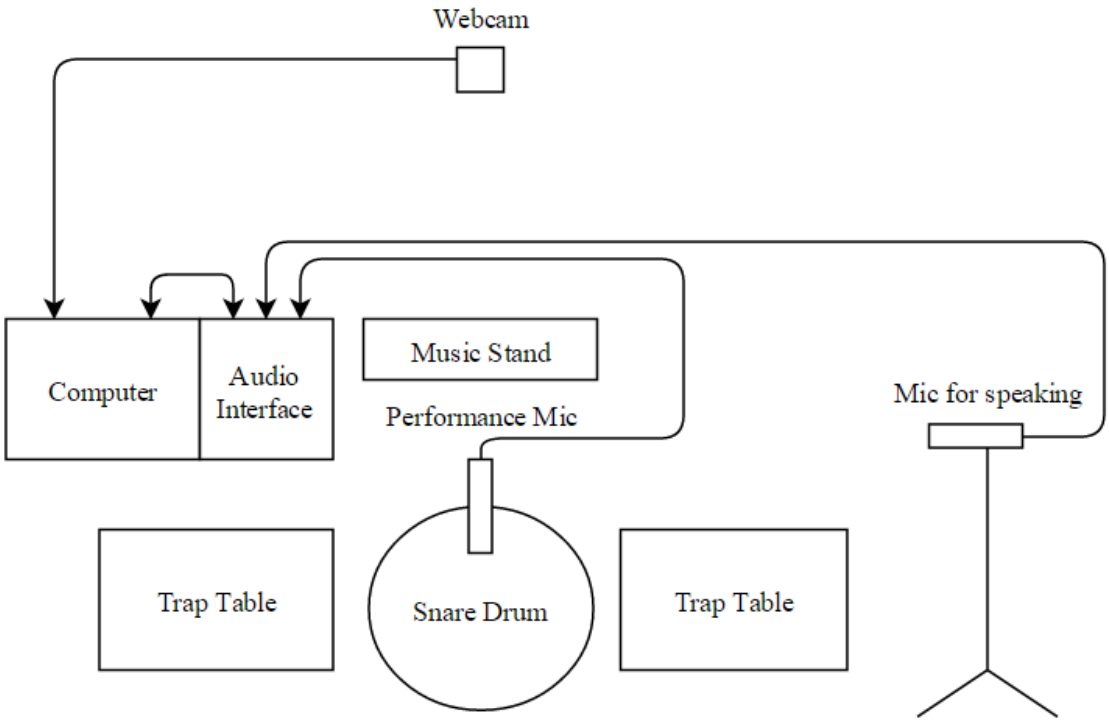
For the beginning telematic musician or group, once the music is learned, there is still a significant amount of preparation necessary for rehearsal and performance. It is essential to allow substantial amounts of extra time before and after a telematic rehearsal for technological troubleshooting. While it may not ultimately be used, it is imperative that this time is built into the rehearsal schedule. Having a set time or first "rehearsal" where the goal is getting technology working for everyone in the group and familiarizing them with the technology can be an excellent use of time for the beginning telematic artist. Including this process in the preparation for the performance will help additional rehearsals run more smoothly. Furthermore, it is highly recommended that members of the group have a secondary method of contact other than the medium being used for performing; that is, if the group is using ConferenceXP, they should also

[118] Deal, Interview.
[119] Ibid.
[120] Deal, Interview.

all have Skype (for example), or phone numbers for the other members of the group, so that they can contact each other through these other methods if necessary. This back-up communication channel allows for problems to be sorted out between group members if issues arise with the primary communication method.

The rehearsal will, of course, proceed similarly to any other rehearsal once technology is working reliably for everyone, but there are a few additional points to consider. Each person needs to be able to communicate inside the rehearsal, meaning that they need to have a microphone available to speak into without too much difficulty. As an example, at a telematic rehearsal I was involved in, a performer had contact microphones on his snare drum, which were all he required for performance. However, this meant that he also needed an additional microphone to speak into during rehearsals so that other group members could hear him. When using an additional speaking microphone, be careful to prevent unwanted noise during rehearsal by only turning the microphone up when using it to speak or otherwise ensuring that it does not pick up other sounds. A sample diagram of my setup is provided in Figure 2.15.

Figure 2.15: Example Telematic Performance Setup Diagram.



A final suggestion for the rehearsal process is to consider time zones when scheduling. For example, a rehearsal scheduled at 9:30 p.m. may occur for another performer at 1:30 a.m. depending on their location. Also a concern, at least in some parts of the world, is daylight savings time. When scheduling rehearsals across a daylight savings time change, it is very important to make sure everyone is aware of how this affects time for each member of the group. I was involved in a telematic rehearsal where members of the group lived in different states in the United States, including Arizona, where daylight savings time is not observed. This led to some confusion about rehearsal times.

2.12 TROUBLESHOOTING

Despite careful planning, it is possible that problems will arise. Therefore, telematic musicians should be prepared to troubleshoot the telematic system as necessary. It is always a good idea when beginning to work with telematic music to contact someone with experience in the field so that they can offer advice during the process. While this text is designed to provide basic steps towards troubleshooting, it is impractical to cover every potential scenario or diagnose every possible problem. An experienced member of the community will be very beneficial and helpful to beginners.

When troubleshooting, it is very important to follow some basic steps. The very first step is determining who is having the problem. While this sounds like something that would be very easy, it is not necessarily so. For example, if one person's audio is coming into another person's speakers with distortion of some kind, the problem could be either person. If there are more than two people, it is easier to identify the issue, simply by asking if player x's sound is distorted for the other performers as well. After determining who is having the problem, the next step is diagnosing it. This can again be incredibly complicated or very simple. In order to diagnose the problem, there are a few basic steps.

The first step is to check the settings and/or connections. If the problem is a hardware issue, check all connections to make sure that they are all correct and are working properly. This may involve a visual check, manually unplugging and replugging all cables, and resetting all levels. Ideally, this process will both determine and solve the problem; if these steps do not, troubleshooting will become more complicated. The second step, assuming the first step was unable to resolve the issue, is to restart everything. Turn off all power, unplug and replug all cables, and then turn on all power. If this step does not fix the problem, each individual piece of

hardware will need to be exchanged to determine exactly what is not working and replace the malfunctioning item. Trial and error is frustrating, but may ultimately be the only remaining option. If possible, having replacement options or testing options available would be useful. For example, it is a good idea to have an extra microphone cable or a microphone to swap in and test to make sure the microphone or cables are working properly. For a simplified checklist, see Figure 2.16.

If there are software issues, the first step is to check all the settings and confirm that they work appropriately. During the initial testing phase it is important that performers write down or otherwise record optimal software and hardware settings for their part of the system. This will make it much simpler to check and determine if settings are accurate in a troubleshooting phase. Also at this point, performers should make sure that no other programs are interfering with the programs in use. For example, some telecommunications software will interfere with other software and prevent it from accessing a video camera. All interfering software programs should be closed, or the process stopped if the program is running in the background. If that method does not work, restarting the computer is likely necessary. Once the computer is restarted, the program should be tested again. If the program still does not work, repeat the previous step. If problems remain after retesting twice, replace the computer system and test again. For a simplified checklist, see Figure 2.16.

The most important thing that anyone can do to be prepared for troubleshooting is to be knowledgeable. Consider the problem of static or unclear sound in an audio transmission. That can be caused by many problems, including: clipping, too much gain, not enough network speed, a compressed audio format, etc. Therefore, in order to diagnose the issue, it is important to be able to tell the difference between types of noise. In the same way, bad quality cables or

unbalanced connections can add extra noise, or a host of other problems. Knowledge goes a long way towards being able to quickly and accurately diagnose problems, and much of this knowledge will come with time and experience. However, when in doubt, always consult with an expert.

Figure 2.16. Troubleshooting Checklists.

Hardware Troubleshooting Checklist
1. Confirm that it is a hardware issue 2. Check all connections and confirm that they are tight and correct. 3. Check all mixer and effect settings to confirm that they are accurate. 4. Make sure no clipping is occurring due to incorrectly balanced audio. 5. Unplug and replug everything, starting with the most likely issues. 6. Replace individual components with extras to try and determine what is not working correctly.

Checklist for troubleshooting software
1. Confirm that every piece of software is compatible with all other applications being used as well as the operating system. 2. Check that all software has been launched appropriately and is working. 3. Check all software settings related to the issue. 4. Check all other software settings. 5. Check for alternate programs interfering with any hardware in use.

Sound is not getting to:	**Basic troubleshooting steps**
Audio interface	1. Check the cable to confirm that it is connected securely. 2. Confirm that signal is being received by checking the audio interface for the visual signal (usually a green or red light) that the microphone is being received. 3. Turn up the gain until the light indicates that signal is received and you can hear it.
Mixer	1. Check cable to confirm that it is connected securely. 2. Confirm visually that signal is being received (indicator light). 3. Turn up the gain until the signal is heard.
Computer	1. Check cable to confirm that it is securely connected. 2. Look for the visual representation of the sound on the screen. This will be different for different programs. 3. Confirm that the audio interface is selected in the program settings for microphone input.
Remote Location	1. Confirm that signal is being sent. If it is not, repeat steps listed above. 2. Confirm that signal is being received. 3. Change the gain on the audio being sent to increase the amount of sound.

Video is not getting to:	**Basic troubleshooting steps**
Computer	1. Confirm that the cable connecting the video camera (if a discrete camera is in use) is connected correctly. 2. Confirm that the program in use has the video camera selected as the source of video.
Remote Location	1. Confirm that video is being sent. 2. Turn the video off and back on, and confirm that video is being sent. 3. Restart the program and repeat steps 1 and 2. 4. Restart the computer and repeat steps 1 and 2.

Quality problem	Basic troubleshooting steps
Audio is distorted	1. Confirm audio settings. Compressed audio of any kind can cause distortion. 2. Confirm that you are not sending clipped audio in the signal chain (no red lights or maxed signal bars.) 3. Confirm that the bandwidth is fast enough to transmit enough data to prevent distortion. 4. Restart the program. 5. Restart the computer.
Video is slow, jerky, or not moving	1. Confirm that the appropriate amount of compression is being used, as well as the proper video resolution. 2. Confirm that there is enough bandwidth for the video resolution in use. If there is not enough, compress the video further or reduce the resolution. 3. Restart the program. 4. Restart the computer.

2.13 TELEMATIC PERFORMANCE CONSIDERATIONS

Telematic performances can create difficult situations for performers based on where on the program the piece is being performed. These situations can include difficulties in setting call times, finding appropriate times to test equipment prior to performance, and more. Some items to consider include placement on the concert program, venue, stage presence, who is controlling audio and video, and when the performers prepare. Placement on the concert program can greatly affect other parameters and should be considered first. Normally, assuming there is not a technical team involved for the performance outside of the performers and a technician managing the video and audio, it is important to have a break before a telematic piece or to program it first on a concert. This will allow for the performers at the main and remote venues to make contact and confirm that everything is ready. This break is not necessary if a qualified person is helping behind the scenes to ensure that everything runs smoothly. If possible, there should be a sound check prior to the event that allows for adjustments in volume levels, confirms

that all performers are ready to go, and verifies that everything is generally set for the performance the way it should be.

The second issue to consider is that of venue. While the main live venue is important, all secondary venues are as well. There should be some prior agreement and planning between venues to ensure that the background for multiple performers is as expected. This could mean that each performer needs only a blank, unadorned space behind them, or perhaps they all need to be on a stage. However it is decided, each performer will need to ensure that they have access to their individual performance space at the appropriate time, and also that their own venue has a fast enough Internet connection, as well as complying with the agreed upon aesthetic considerations.

The third parameter is stage presence. Again, this requires proper prior planning to ensure that the desired effect is achieved. If there is a technician assisting at the live venue, he/she should attend at least the sound check prior to the performance to be aware of the necessary specifications for the performance. This person can also confirm that everyone is ready to start the piece before it begins.

Essentially, the requirements for successful telematic performance are met through advance planning. It is important that each person involved understands his/her roles and responsibilities in the process, and that all aspects of the performance are discussed and prepared for in advance. Every individual involved in a telematic performance will most likely have greater responsibilities than in a performance without the added element of telematics. For a performance day checklist, see Figure 2.17.

Figure 2.17 Performance Day Checklist.

Performance Day Checklist
1. As a performer, confirm that all the technology is working accurately before the performance call time, including audio, video, hardware, and software. 2. Have a call time for the performers to check in and test the electronics with enough cushion to troubleshoot. 3. Set the final mix, route all the audio/video to appropriate locations, and confirm that the technology is working as intended. Have a person whose sole job is to coordinate technology and route audio/video to the staff (either performers or technicians) of the performance venue. 4. After the call time, have a set performance time so the performers know exactly when they need to be in position to play.

This chapter covered the basics for a beginning telematic musician to feel comfortable with getting involved in a telematic performance. While the technical aspects are certainly complex, as the musician gains experience with the technology, the information will become more familiar.

CHAPTER III: TELEMATIC MUSIC TODAY

Telematic art is now a viable art form due to the ever increasing technological capabilities we have. In chapter one, the history that led to telematic art was outlined, but the reality of a new art form is rarely the same as the original idea. The practical application of the ideas creates a varied reality, as some artists choose to forge a new path instead of the one laid out by the original thinkers, even as others strive to follow precisely in the footsteps already marked out. The incredible diversity in approach to telematic art shows that individual artists may lack knowledge of the historical background of telematic music, or they may have purposefully decided to ignore its history. As such, there is a current trend of specific arts becoming telematic, as in telematic music, as opposed to the historical intention of telematic art as presented in chapter one. However, this diversity is neither good nor bad. Instead, it is the beginnings of exploring new possibilities without the burden of history. These artists and their performances may not be genuinely telematic art in a historical sense, but that does not render their performances invalid. Rather, they have become valid telematic performances in that they use telecommunications in some way, and thus are called telematic as well. Of course, equally valid are performances and performers who are devoted to precisely following the prescriptions of telematic art as set down by Ascott, as presented in chapter one. Additionally, performances that are largely music-centric fall into a category known as telematic music. This can mean that telematic music contains multiple art forms, such as video, and video processing, but is still largely considered music when viewed through the paradigm of today's general artistic sensibilities.

There are a number of musicians today who are well-known figures in telematic music, including artists in the United States such as Scott Deal, Pauline Oliveros, Chris Chafe, Mark

Dresser, and many more. Telematic music is a global phenomenon, with many different institutes around the world taking part in telematic performances and being active in the field. However, while there are many performers and performances of telematic music in the world today, they are still dwarfed by the number of more traditional musical endeavors. This chapter will discuss how telematic art is being realized today by artists as telematic music, incorporating an interview with Dr. Scott Deal, and also discussing one of the largest telematic works to date, *Auksalaq*.

3.1 STATE OF TELEMATIC MUSIC

Many factors impact the current state of telematic music. In the academic world, it is always important to consider what has been written about the topic, as well as where telematic music is being performed, who is performing it, and how long performances have been occurring. It is clear that in the last fifteen years telematic music has seen exponential growth. This is due to many different factors, but most importantly the increasing technology which allows for telematic music to take place. Before the Internet, telematic music was very limited in scope and capabilities, but now, with the constantly increasing connectivity speeds, it is becoming easier and easier. Telematic music has also seen such exponential growth because relatively few people perform it, which means that for each new person who participates in the art form, the performers increase by a greater percentage.

According to Deal, the state of telematic music today is actually quite good, particularly since the genre has really only been viable for the short time of approximately twenty years.[121]

There have been many writings about telematic music, either specifically about the genre or about technological elements of the genre in the musical world. One of the most significant articles about telematic music was the article "Telematic Music: Six Perspectives." This article

[121] Scott Deal, an interview by Mark Cook, (Indianapolis, IN), November 2013.

came about as a result of a telematic concert in 2007.[122] The concert led to a telematic music panel at the International Society for Improvised Music Conference also in 2007, though the article itself was not published until 2009.[123] In the article, the six authors discussed many different ideas, including personal background in the field, technological aspects, specific pieces, and how their different perspectives related to the concert that they performed. This article is the only one of its kind that I have found, and it is significant in that it addresses telematic music performance from multiple angles instead of just a technological one. Conversely, there has been a great deal of writing about specific technologies related to networked performance. Several articles have been written by Chris Chafe, Director of the Center for Computer Research in Music and Acoustics at Stanford, and a leader in the technology developed and used for telematic music. He developed JackTrip, and has authored any number of articles about software, network performance, network delay, and how the Internet affects music.[124] While these and other similar writings are important, they ultimately address a single part of telematic music, the technology, and leave out the other elements, audience interaction and incorporation of multiple art forms, entirely. This is important to note because most writing on telematic music has fallen into this category. However, while much of the current scholarship focuses on technology, there is at least a significant amount of current scholarship on telematic music, which should be encouraging to the aspiring telematic artist.

There are other significant signs that telematic music is entering into our culture, if mainly the academic culture, as well. Telematic music has been discussed and performed at a large number of conferences and festivals, and has found homes in different educational

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[122] Oliveros, Pauline, Sarah Weaver, Mark Dresser, Jefferson Pitcher, Jonas Braasch, Chris Chafe, "Telematic Music: Six Perspectives," *Leonardo Music Journal*, vol. 19 (2009), 2.
[123] Ibid, 1.
[124] For some of Chafe's writing, as well as other researchers in the field that are associated with him, please visit https://ccrma.stanford.edu/groups/soundwire/publications/

institutions in recent years. The range of the conferences where it has been performed or presented on is extremely significant because the conferences are not just limited to music events. Some of the conferences and festivals include the Association for Computing Machinery's (ACM) conference, called SIGGRAPH, Supercomputing Global, The International Computer Music Conference (ICMC), ARTech 2008, the Percussive Arts Society International Convention (PASIC), and many more.

There are also many institutions that have regular telematic performances, if not specifically dedicated telematic ensembles. These places are mostly where well-known telematic artists work or lead the ensembles. At the Rensselaer Polytechnic Institute, Pauline Oliveros, a very important figure in American music in the twentieth century, runs Tintinnabulate; at IUPUI Scott Deal runs the Telematic Collective; and there are additional performances at many places including the Sonic Arts Research Centre (SARC) in Belfast, the University of Alaska – Fairbanks, Grieg School of Music in Bergen, Norway, and many more.[125] Additionally, most major universities with a serious music technology department or similar element will likely have people who are familiar with telematic music or are interested in it.[126]

Pauline Oliveros is a particularly important figure in telematic music today. Oliveros has been performing telematically for more than twenty years. Her importance extends beyond just the telematic music realm; she is also a very important figure in the broader musical world today, particularly in American music. She has been the impetus behind a great number of telematic performances and is considered by her peers to be one of the pioneers in the field of telematic music.[127]

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[125] Deal, Interview.
[126] Ibid.
[127] Ibid.

One final aspect of telematic music and art that is encouraging today is its longevity. As has been mentioned, telematic music is relatively new, and has a short performance history of approximately twenty years. Oliveros performed telematically in 1991 and still performs with telematics. Before the Internet became widespread, she performed using the telephone networks.[128] Another example includes the company Another Language. They had collaborative projects from 2003 to 2010, a series of performances they called Interplays, which were telematic performances that they did once a year. Since then they have continued to explore telematic music, though not under the Interplays title.[129]

While telematic music is clearly gaining popularity and improving, there are some serious limitations to the format. It is a niche, which, while still growing, is not a very large genre when compared with the rest of today's musical world. Part of the reason for this, and another limitation of telematic music, is the trend of performances being centered around improvisation as opposed to completely composed pieces. While there are pieces that are completely composed in the telematic genre, they are few and far between. I believe that changing this will lead to a greater appeal for a wider audience. Telematic music should not be limited to only improvised music, and with the continued growth in technology, the limitations that lead to the use of improvisation become less tangible.

All of these aspects of telematic music today show that it is growing. The trend in telematic music and all of telematic art is very positive. As our culture moves more and more towards online interconnectivity, I believe the interest in telematic music and art will continue to grow. The continual technological improvements we see today push us further and further in this direction, and the caliber and quantity of performances of telematic music and art will direct the

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[128] Oliveros, "Six Perspectives," 2.
[129] This company can be found online at www.anotherlanguage.org.

art form into a more public view. At the same time, telematic music is unlikely to become a revolutionary movement; the interest and impetus for such a niche product is unlikely to gain too much traction in the broader market. I firmly believe that telematic music will continue to exist and gain popularity, but it is unlikely to rival the popularity of other, more entrenched musical and artistic pursuits.

3.2 THE INTERVIEW

In researching the topic of telematic music, I decided it was necessary to speak with a well-known telematic artist, Scott Deal, about the subject and gather his viewpoints about various aspects of telematic art. Scott Deal is a Professor of Music and the Director of the Donald Tavel Arts Technology Center at Indiana University Purdue University of Indianapolis (IUPUI). He has been involved with telematic art for over ten years.

3.2.1 Short Biography of Scott Deal

For Deal, telematic art became a reality because he lived in Alaska. Living in a remote place and teaching at a small university in Fairbanks was the perfect opportunity. The University of Alaska – Fairbanks was eager to foster interdepartmental cooperation, they had a federally funded supercomputing center, and everything just happened to come together in the right way at the right time. In general, a lot of telematic art began to come about this way because of the prevalence of supercomputers and the funding for these types of projects that occurred in the 1990s and 2000s. Most supercomputers and supercomputing projects have been replaced with Information Technology Services at various universities. In the 1990s, through his connection with the supercomputing center, Deal gained access to a community of people who used the

Internet for collaborative projects, through software known as ACCESS GRID. This community was called ARTGRID, in reference to the software. It was an informal consortium consisting of many different universities around the world, and they worked together and created some performances. One of the groups that came out of this consortium was called Another Language Performing Arts Company, and they began doing telematic performances in 2003. During this period, Deal also performed and presented at many major conferences such ICMC, SIGGRAPH, Supercomputing Global, the Association for Technology in Music Instruction's (ATMI) combined conference with the College Music Society (CMS), and many more. Deal worked with other artists and performed telematically for years from the University of Alaska, and then in 2007 he moved to IUPUI. Since coming to IUPUI, Deal has continued to engage in telematic art, lead telematic ensembles, and work on many other artistic projects, including *Auksalaq*, a telematic opera which will be discussed in depth.

3.2.2 Aesthetics of Telematic Music

As far as general aesthetics of telematic music are concerned, these again vary widely from artist to artist and piece to piece. However, Deal has very strong opinions on portions of the subject. To him, online streaming is not a true representation of a telematic performance, as it should involve a live element. In other words, the audience needs to be physically in the same room with some of the performers to have the interaction necessary from performer to performer, and from performer to audience, to create an accurate representation of the work. The performance, when viewed as an online stream, is simply a minute portion of the whole.

Immersion in a media enriched environment and the combination of "live flesh"[130] and the Internet is very important to an accurate telematic experience.

One of the most important elements that Deal stressed in the interview was that telematic art of any kind is about relationships. It is about creating relationships between the audience and performers, yes, but also about creating a relationship between the artists. Telematic art is about creating a community, in which creativity exists in collaboration, in which works are created as a group, and not in isolation. This is a similar sentiment to what Ascott expresses.[131]

3.2.3 Technology

The technology that is used today is quite interesting, and is mostly covered in another chapter, and the history of the technology has been discussed as well. However, at this point I will discuss some technology that Deal mentioned in the interview. A lot of the technology that has been in use since telematic music really became workable either is not used anymore, or has transformed into something else. For example, Deal described ACCESS GRID, which is a computer-based, videoconferencing technology that was developed in Argon Laboratories. It differs from standard video conference technology due to media richness, by using multiple projector displays of multiple video and data streams. It also has multiple camera angles for participants, and it is designed for education.[132] ACCESS GRID was federally funded, and therefore free to use and download, but is no longer widely used today. Deal went on to explain that the science and engineering community used different software, a combination of Python,

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[130] Deal, Interview.
[131] Roy Ascott, "Is There Love in the Telematic Embrace?" In Telematic Embrace: Visionary Theories of Art, Technology, and Consciousness, edited by Edward Shanken, (Berkeley and Los Angeles, University of California Press, 2003), 241.
[132] Richard Caladine, "Access Grid," In *Enhancing E-Learning with Media-Rich Content and Interactions,* ed. Richard Caladine, (2008), accessed February 17, 2015, 256-7.

for video transmission, and Rapid Audio Transmission (RAT) for the audio. These options have been replaced by software applications created by large companies. According to Deal, today there are various applications that do similar jobs. Adobe has Adobe Connect and Movi. These are conferencing tools, which are not designed for art. There is very little software designed specifically for art, which creates difficulties in starting to work with telematic art. Additional technology that has been developed by people in the Internet2 consortium is called LOLA, which stands for low latency, and it is used for high speed audio and video transmission. Unfortunately, Deal does not expect LOLA to gain widespread acceptance because it is very expensive. In his opinion, for technology to become popular in today's world, it must be reliable, cheap, and easy to disseminate. Other types of technology have existed, and continue to be created, but many of these lack staying power. Deal specifically mentioned technology such as the Netronome, essentially an online metronome that allows musicians to sync up to an identical clock for performing. However, many of these pieces of technology, such as the Netronome, are either proprietary, unreliable, or expensive, leading to their eventual fall into disuse. This can happen regardless of whether the piece of software is well-designed or the best tool for the job.

As can be seen, there is a great deal of technology in existence for use in performing telematic music. This variety, while ultimately beneficial to telematic music, can have unfortunate consequences today. There is the constant possibility of technology becoming obsolete, and the difficulty of collaborating with individuals who use different technology than the performer may be familiar with. Practitioners of telematics are still in the process of creating the "best" technology, instead of standardizing a platform for it.

3.2.4 Problems in the Telematic Music World

Some of the issues arising from a limited outlook on telematic art can be seen in the telematic music world. Deal believes that many different groups that are focused on telematic music have a limitation in their view of how to present it, in that they only care about audio. While telematic music is, by name, concerned with music, Deal believes there should not be a lack of attention to video. Deal goes on to suggest that what many people in the telematic music community do is focus on high quality audio while letting the video look very poor. For example, they may use a wonderful program for audio transmission, and at the same time use Skype for video. This can cause enormous problems as Skype's video transmission is inferior to the audio program or transmission. A lack of attention to detail is a huge concern, as people will still see the video. Deal implies that instead of allowing any one element to suffer poor quality, musicians should instead focus on creating a quality product in every aspect.

3.2.5 The Internet

The Internet is one of the most important elements of telematic performance. However, the Internet can cause problems, and as Deal says, "should be viewed…with fear and trepidation."[133] After all, how many times when using the Internet does one have problems with it? Inability to load a page, or something on the page loading incorrectly, too many people trying to watch videos online at the same time, and the list of potential problems could continue forever. If we consider all the potential issues that can occur with loading a web page, it is easy to see how much more concerning live streaming audio, video, or both can be. These issues can all occur at any point of the live stream, as opposed to when only trying to load a single page. So a telematic performance can be seen as a precarious undertaking, because there is no guarantee

[133] Deal, Interview.

that everything will happen correctly. Some of the potential problems relating to the Internet are: packet loss, visual artifacts, audio distortions, and more. Packet loss occurs when packets of data traveling across the Internet fail to reach their intended destination. This loss of data can cause the other potential problems. Visual artifacts are anomalies represented in telematic art on a screen. These can be caused by many issues either within an individual computer, or through the Internet. Audio distortions can also be caused by a multitude of factors within a telematic setting and can happen at any part of the data chain. These few issues can occur in so many places that it is an incredible feat that telematic transmissions happen at all!

In addition to the problems inherent in the Internet, Deal notes there are many advances being made as well. In many places, including the United States, there is a great deal of work being done by various entities to create an infrastructure not unlike the railroad system, but for high speed Internet. These companies are laying cable, mostly fiber optic cable, and it is sitting there mostly dormant, and is known as dark fiber. Google fiber is an active example of this type of infrastructure.[134] This cable is capable of significantly higher speeds than what is currently in use, including gigabit connections. Unfortunately, fiber optic connections are not available to everyone yet, though some groups such as the Internet2 consortium have access to them. Deal emphasizes that while this cable and the significant speeds it produces are a great boon to telematic art, they are not necessarily a prerequisite of the creation of it, though they do allow for higher quality. The question connected with this, is whether telematic art is for anyone, or only the privileged few. If it is for just the privileged few, then being a member of a consortium such as Internet2 is a necessity; otherwise, the goal is figuring out how to do telematic art without it. Deal's solution is simple: perform anyway. He argues that limiting the capability and possibility

[134] Ingersoll, Minnie and Kelly, James, "Think big with a gig: Our experimental fiber network," (accessed May 6, 2015), http://googleblog.blogspot.com/2010/02/think-big-with-gig-our-experimental.html.

of participating in this genre of art is counterproductive to the art form. Deal's alternative is simply to not worry about the limitations, understand them, work within them, and accept them. By doing so, the performer embraces telematic art as a whole. Sometimes it is not perfect, and it should not try to be. However, the high speed connections exist regardless, and are only limited by available speeds. Internet connections becoming ever faster allow for increasing segments of the population to have access to telematic art, which will also have significant impacts on the ease of performing telematic art outside of specific locales which have access to very high speed connections.

3.2.6 Telematic Music as a Niche

In considering telematic music, one issue is whether or not it exists as its own genre or as part of another. Music has been performed on concert stages for thousands of years, but does telematic music have to follow precisely in the established tradition? Deal says no, and it makes sense. Telematic music uses technology for the transmission of sounds, essentially making technology and the Internet part of the instrument itself. Thus, when certain issues arise, such as distortions of sounds in performance, Deal argues that we should accept that as part of the genre, part of the indelible understanding of working with this technology. We can even embrace it, and allow for it in music being written for the medium, to have the flexibility or creativity to use the imperfections implicit in working with the Internet. This point is also linked with the previous discussion of Internet speed. The speed of the Internet should be taken into account with the creation of telematic music and considered as a requirement of the piece. Different pieces may need different speeds, just like different musical performances use different instruments. Just as

there should be no judgment between pieces with different instrumentation, so telematic music should be free to conceive of the use of technology in whatever way suits the composer.

The point is, however, that a telematic experience is not the same as any other musical experience. It exists in a different way than performing a string quartet for an audience in a concert hall does. Telematic music and the people involved in telematic music should embrace this art form and all of its idiosyncrasies instead of trying to bind it with the conventions and traditions of other concert music. Telematic music has a performance practice of around twenty years and is still in its infancy; it should surely be allowed time to grow and create its own conventions.

3.2.7 Other Uses of Telematics

The use of telematics in art is very limited as compared to its use in other fields. Telematics is by nature designed to help people communicate, and therefore has a very large presence in many businesses, as well as other places. Most video conferencing software is designed for exactly that purpose, a video conference. It was designed for meetings which take place both in the business sector and in people's homes as they connect with others. However, Deal notes that, surprisingly, telematics are appearing in churches. Entities known as multi-site churches often use telematics in order for multiple locations to talk to each other or worship together. This proliferation of telematics leads to a familiarity with the concept which will ultimately become useful in increasing the comfort level of people who see it in art.

3.2.8 Telematic Music Composition

When asked about telematic music composition, Deal suggests that there are very few composers who compose for the genre. He believes it to be less than two hundred composers worldwide. This number is surprising and disappointing. While there seems to be considerable support across the world for telematic art, perhaps the short lifespan thus far of telematic music has restricted those who compose for it, leading to many performers adapting existing works for telematic music, a practice with limited success. It is difficult to find music that was created with open enough parameters to allow for performers to make such a large change to aesthetic elements of the piece without distorting the piece itself. However, there are quite significant limitations for a telematic composer at this time. Deal suggests that composing for telematic music is quite challenging and needs to consider the newness of the genre. What this involves for composers is understanding the relative difficulties and limitations of high speed data transmission as well as the small number of performers available. Oftentimes these limitations lead to music that is open in instrumentation, as relatively few performers are aware of or interested in this art form. Also, the composer will often have to create a fairly loose rhythmic structure, allowing for the variables of the Internet.

3.3 *AUKSALAQ*

My interview with Scott Deal supplies a thorough look at the world of telematic music today. Next, I will look at one of the most recent and important telematic works to date, *Auksalaq*. I was first introduced to this piece at a percussion convention (PASIC) in 2009 when it was still in its beginning stages. At the time, I saw a short video of a portion of the piece that had recently been performed. I have since seen the premiere of *Auksalaq* online on October 29, 2012.

I was also able to obtain a score for study and have used that as well as many materials provided by Scott Deal to develop a greater understanding of *Auksalaq*. *Auksalaq* is a telematic opera co-created by Matthew Burtner and Scott Deal. According to the *Auksalaq* website, "this project was in the making for five years. Portions of *Auksalaq* were performed in 2010 at the Ear to the Earth Festival, the Intermedia Festival, and in 2012 at the Network Performing Arts Symposium."[135] *Auksalaq* also won an Internet2 IDEA award in 2011.

Auksalaq is a piece specifically about climate change. It focuses on the recent changes in the Arctic regions of the far north. *Auksalaq* itself is an Inupiat word which means melting ice.[136] The opera tells a story through live music, visual arts and commentary, integrating these elements to present an interactive, multimedia experience. In a document I received from Scott Deal, he states:

> The composition foregrounds "remoteness" creating a spectacle that is both complete and incomplete in each location. This perception of both embodied and disembodied place creates a unique sense of attachment and intimacy to the performance. In this way *Auksalaq* captures a feeling experienced by people living in the far north, a centered feeling of deep attachment to the land but also an uncomfortable sense of isolation. The people of the Arctic call this profound attachment to the land, *Unganaqtuq Nuna*.[137]

In this telematic piece, we can recognize the three elements of telematic art. First of all, the piece involves performers in multiple locations using telecommunications technologies to be "present" at the performance sites. Secondly, the piece exemplifies the integration of artwork by utilizing media in various ways throughout the work, including Arctic images and scientific data and video, as well as video processing. This demonstrates an integration of multiple art forms. This area of the opera is perhaps weakest, in terms of how *Auksalaq* fits into the definition of

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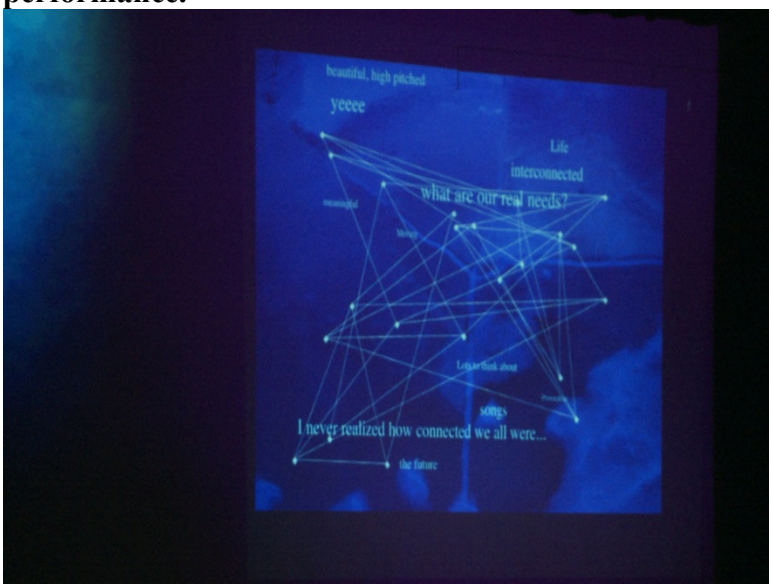
[135] "Performances," accessed February 17, 2015, http://auksalaq.org/main/performances.
[136] "About Auksalaq," accessed February 17, 2015, http://auksalaq.org/main/about-auksalaq/.
[137] "About Auksalaq."

telematic art. The integration of art forms is also addressed in an unusual way, namely by showing interviews and discussions with scientists. This commentary actively incorporates the ideal of integration in a new fashion, assimilating something inherently unartistic into a work of art in order to demonstrate a point. Finally, *Auksalaq* also involves overt audience participation by utilizing software called Network-Operational Mobile Applied Digital System (NOMADS)[138]. NOMADS allows the audience to interact both with other members of the audience and the piece in many ways. Some information given by the audience (geographic locations) is used in a part of the piece itself, and the audience can also cause sound to happen at specific points by interacting with the software. NOMADS also functions as a group chat for the audience, allowing them to talk to each other while the piece is happening.

Figure 3.1: Image of the NOMADS software displayed on-stage at the premiere performance.[139]



[138] Matthew Burtner, "Scored Music for *Auksalaq*: A Multimedia Opera." Self-published, 2009, 2.
[139] "Photos," accessed May 7, 2015, http://auksalaq.org/main/auksalaq-web-photos/

Due to the nature of the work, *Auksalaq* is difficult to categorize and discuss. Therefore, specific examples will be made in reference to the premiere performance of the complete work which took place on October 29, 2012. The piece is highly variable in its nature, with the various musical elements designed to be reordered as necessary, which, while highly beneficial to the creative process of the piece, also presents difficulties in examining the formal structure. Despite the flexible nature of the piece, this section attempts an analysis based on my viewing of the premiere performance, examination of the score, information gathered from documents provided by Scott Deal, as well as my interview with Deal.

Auksalaq was designed specifically as a telematic opera, which gives the necessary corollary that it was not designed to be performed with all performers in the same location. The directions for the work indicate a great deal of flexibility, both with the number of locations and how the work is performed. The performance indications are:

> The ecoacoustic chamber music of Auksalaq is designed to be performed between remote concert spaces. In each location, musicians may play from the scores included. These scores overlap and interlock into a multi-space telematic performance. A master score is created for each performance and used to let the smaller ensembles know exactly when and how to coordinate within the larger context of the full opera. The following score is not organized linearly in time but rather by elements. These elements will be combined vertically later. They are designed to work in counterpoint together.[140]

The premiere of *Auksalaq* utilized performers in six different locations including the University of Alaska Museum of the North, Tavel Center at IUPUI, the Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT) at the Schullich School of Music, McGill University in Montreal, Grieg Academy of Music in Bergen Norway, and the OpenGrounds Studio at the University of Virginia.[141]

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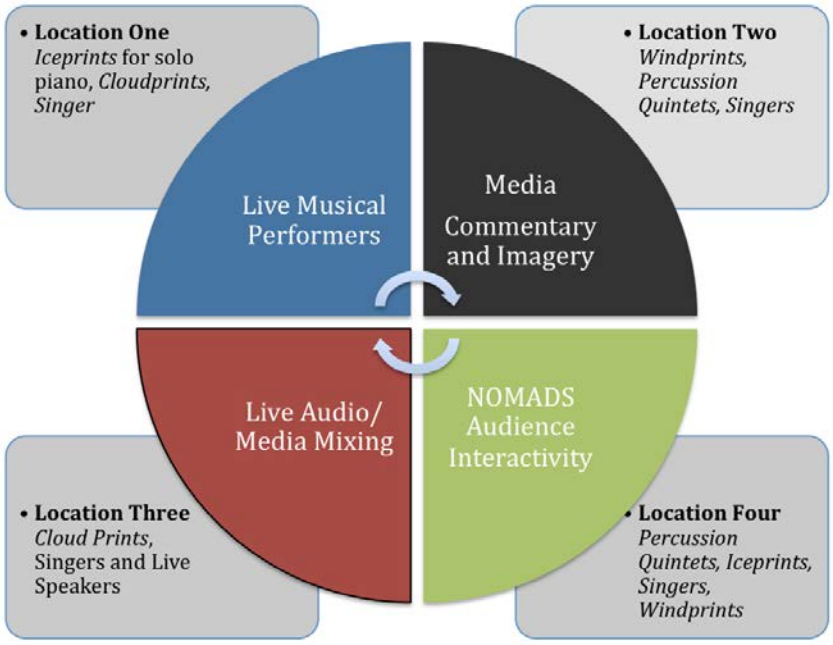
[140] From the Auksalaq score, pg. 2
[141] "Main," accessed May 7, 2015, http://auksalaq.org/main/auksalaq-web-photos/.

3.3.1 Explanation of Performance Venues

Auksalaq is designed to be a multiple venue performance. This means that at each location where people are playing, there is a performance and an audience. In this way there is no one central performance venue; each individual venue has an equally valid and important performance. As a prerequisite for this, each venue also receives the other locations' performances, video and other interactivity, as necessary. The individual sites, therefore, all have the essential elements of the opera, but have a very different audience experience. The individual musical elements of *Auksalaq* are thus designed to be self-sustaining, sounding complete independent of other music, but also able to combine together with the rest of the music, creating a more intricate texture. An example diagram of how these locations interlock can be seen below in fig. 3.2.

Figure 3.2: Sample multiple site performance diagram. Created by Scott Deal.[142]



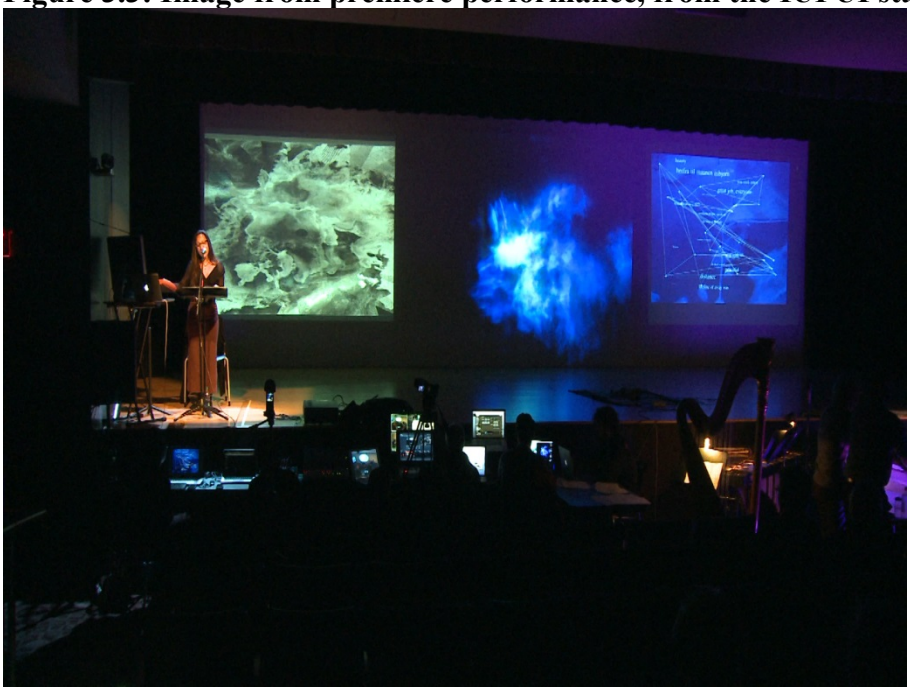
3.3.2 Brief Analysis

Auksalaq is a piece that was designed with telematic performance in mind, and thus exhibits some formal features intended to make telematic performance easier. While the formal structure of the piece is largely open, it consists of a number of discrete features. There are eight musical elements to the piece, most of which utilize different instrumentation. They are: "Iceprints" for 1-3 pianos and Arctic Ocean sub-ice ecoacoustics, "Iceprints Vocal Part" for voice and Arctic Ocean sub-ice ecoacoustics, "Windprints" for 1-3 flutes and mixed chamber ensemble (strings, winds, brass, percussion), "Cloudprints" for mixed chamber ensemble (strings, winds, brass, percussion), "Auksalaq (Aria)" for voice and NOMADS, "Unganaqtuq Nuna" also for voice and NOMADS, "Six Ecoacoustic Quintets" for percussion ensemble, and

[142] Auksalaq, "How Auksalaq works," (Accessed May 6, 2015), http://auksalaq.org/main/how-auksalaq-works/.

"Six Ambient Extensions" also for percussion ensemble. In addition to the musical elements, there are several other features to the piece, both video and audio. One is simply video of a scientific conference, and many meetings and interviews with scientists about climate change, as well as graphs and data concerning climate change and polar ice. The other video element is video of polar regions that is being processed. There are additional possibilities as well, including superimposing images from the score onto the screen. There is also processed sound, consisting of manipulations of portions of the acoustic music in the piece. These all work in conjunction with video of the performers on multiple screens at any given time. See fig. 3.3 for an example of how this was done in the premiere performance of *Auksalaq*.

Figure 3.3: Image from premiere performance, from the IUPUI stage.[143]



[143] "Media," (Accessed February 17, 2015), http://auksalaq.org/main/media/.

The combination of the discrete elements can be done at will. This means that each performance of the work will be different, and thus should be analyzed differently. The premiere performance was very clearly delineated into a three section work, with the outer sections characterized by music in a clear arch form and the middle section mainly given to the videos of scientific data and interviews. This form was clear from the viewing of the work, but it is also shown in the form diagram created by Matthew Burtner and found in Appendix C. The structure works quite well and provides a natural flow to the piece that allows the audience to become immersed in the world of the polar region before the scientists discuss it, and then to have all of the explanations couch a second look at the same region, giving the audience a new perspective on what they have seen.

Each of the musical elements has specific ideas, most of which relate to the polar region in some way. However, the two arias are distinct from the rest in that the words are generated by the audience using NOMADS. The "Unganaqtuq Nuna" aria uses geographic locations mentioned by the audience. In order for this to happen, the audience is asked to enter their hometown into NOMADS, and then the singers choose at will from the data. The "Auksalaq Aria" is similar in that the audience is asked to input their thoughts into NOMADS, and then the singers select words, phrases, or sentences to sing, representing the collective thoughts of the audience. In the premiere, these arias were strategically located within the piece at the end of the first section and the end of the third section, which gave the audience time to familiarize themselves with the software and respond to what they see and hear.

The first section of the piece consists of percussion sounds moving to chamber ensemble music and later adds the "Unganaqtuq Nuna" aria. This section encompasses all of the various locations over time, with one specific location providing the initial percussion music and others

providing the additional music throughout the section. NOMADS is used twice in this section, at the beginning to create sounds, and at the end to enter information used in the aria.

The middle section is the simplest section, consisting of very little music to distract from the scientific data and interviews on screen. The only thing happening musically in the middle section is portions of the percussion ensemble pieces “Six Ecoacoustic Quintets” and “Six Ambient Extensions.” During this section, there is no audience interaction through NOMADS.

The final section completes the symmetrical arch form with very active chamber music that fades back to percussion ensemble and the ending. The exception to this palindromic idea is the “Auksalaq Aria” which occurs at the end of the piece. This aria is easily explained as being outside the general structure of the piece, as the audience is asked to react to everything they have just seen and heard. It cannot realistically occur much earlier in the piece without being confusing and generally disruptive to the environment created. Both this and the “Unganaqtuq Nuna” aria have been strategically placed and were not disruptive to the general understanding of the overall form.

3.4 FRAMEWORK FOR ANALYZING TELEMATICS IN MUSIC

Telematics in music need to be considered when analyzing a piece. The telematic elements of a piece factor into the work as one element of a whole and should be seen that way. Generally, telematics should be viewed in line with more traditional elements of a piece of music, namely those of location, instrumentation, duration, formal structure, and other building blocks of the work. Technology in music or in any artistic endeavor should not be the purpose of the art, but should instead enhance the art in some way. When the technology becomes the centerpiece instead of an element of the whole, it will automatically detract from the overall

impetus of the work. Therefore, the question is not what are the telematic elements of a work, but rather, how do they function within the whole?

Telematics can be used in many ways in music, and in *Auksalaq* we see some specific applications demonstrating that this opera was intentionally designed with telematics in mind. There are two clear ways telematics is used in *Auksalaq*; first aesthetically, to enhance the idea that we are all connected, and second, using telematics to give a sense of place to the disparate elements of the performance, which helps reinforce the overall structure of the piece.

The message of *Auksalaq* is in many ways twofold. It is a telematic opera about climate change, but hidden within that message is a second one, that everything on Earth is connected. This is modeled throughout the opera by the discussion of the scientists as they speak about climate change and how it is caused by the interaction of elements of the Earth's ecosystem, and largely human interaction with that system. The not so subtle point is that our interactions with the Earth have brought about this devastating change in the polar regions of the world, and that change will soon have a devastating effect on the rest of the world as well. This message that everything is interconnected is in perfect symbiosis with the ethos of telematic art. Aesthetically, the telematics reinforce the ideas of the work on a very basic level; therefore, there is no real need to look for deeper connections between various locations and their interactions in order to observe the fact that telematics is integral to the piece. This consideration of location addresses a simple yet important question that should be asked about telematic music: Why is it being performed telematically? This question can also be stated as follows: Why are we using telecommunications to perform? There are countless answers to this question, from something as simple and utilitarian as it being a cost saving measure, to it being an integral element of the overall work. This question will lead us to a potential great divide in the future: is telematic

music really telematic art if there is no artistic reason for the telematics, or is it merely a concert piece of music that is performed telematically? This is a large concern at this point in time because these two ideologically differentiated musical events are taking place, with both being considered the same type of performance by most people. However, we see in *Auksalaq* an excellent example of the use of telematics to reinforce central concepts of the piece, a clear justification of why the piece is written with telematics.

The second element of the telematics in *Auksalaq* is shown in the way telematics reinforce the overall structure of the events. This is harder to analyze, due to the variability of the piece and the overall flexibility of the performing locations. In general, it is likely that musicians at each location learn one or more of the musical elements based on available instrumentation, and thus when each location performs during the piece, it emphasizes the formal structure. While this particular example was true for my view of the premiere, depending on the groups of musicians available in each location, the performance can vary significantly as one location could play more of the individual musical elements. However, the premiere of the piece has a clearly formulated arch structure, with musical material creating the form. The form is enhanced by the location specific performance. Looking very narrowly, the piece opens with percussion sounds, among others, and then the same musical material returns at the end. For the premiere performance, because the percussionists were in a remote location, they were projected on the screen. This helped to tie in the fact that musical material was recurring and also reinforced the form. This is not necessarily subtle, nor is it required, but the telematics in the piece reinforce the aural checkpoint in the performance I saw.

Simply put, if telematics are essential to the nature of the work, they should be considered as part of the framework for analyzing and evaluating it. Once the telematics are

determined to be essential, then they can be evaluated for effectiveness. In the case of *Auksalaq*, the telematic elements can be determined to be effective if they convey the two previously discussed points of telematics in the piece. They clearly enhance the work rather than detract from it, and that creates a logical and well-done element of the piece. Thus, from a formal point of view, the telematic elements of a piece can be seen as a reinforcing element of the overall structure of the piece. Telematic art is encompassed as more of an aesthetic genre than a discrete process to be analyzed in conjunction with the rest of the work. It is an ethos, as opposed to a technicality.

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APPENDIX A: GLOSSARY

ACCESSGRID – A computer-based, videoconferencing technology that was developed in Argon Laboratories. It differs from standard video conference technology due to media richness, by using multiple projector displays of multiple video and data streams. It also has multiple camera angles for participants, and it is designed for education.

Adobe Connect – A videoconferencing platform developed by Adobe Systems. It is Adobe Flash based and is currently marketed towards businesses.

ARPAnet – a system that developed prior to the Internet, ARPAnet was a network created by the United States Advanced Research Project Agency in 1969. Many new technologies were pioneered on ARPAnet, including packet switching and TCP/IP.

Audience Interactivity – A foundational concept of telematic art in which the audience is considered to interact with the performance in some way. This concept can be traced to cybernetics as feedback, and is an integral part of an intelligent cybernetic system.

Audio Interface – Hardware designed to allow analog and digital signals to be converted back and forth. This hardware allows analog audio signals coming from standard analog components, such as an analog mixer or microphones, to be converted into digital signal to allow the signal to be recognized and used by a computer. The signal can also be converted in the opposite fashion with a digital signal coming from the computer and being transmitted to an analog sound system.

Audio routing software –a program designed to take a digital audio signal in a computer and route it to the appropriate digital location. For example, JackTrip routes audio by bypassing many of the processes in a computer which will slow down the audio signal, avoiding latency.

Audio visual synchronization – This synchronization refers to how closely matched audio and video signals are to each other. Federal standards indicate that the two signals should be within 30ms of each other so as to avoid a noticeable synchronization error.

Auksalaq –the world's first telematic opera. In additional to typical operatic elements, it incorporates scientific discussion of climate change, video, video processing, and performers in multiple locations.

Backstage – This software program is a private program created by Dr. Chulyuan Meng. It is essentially a master clock designed to keep performers in multiple locations synchronized in order to accommodate performances with specific timings.

Codec – a program that compresses or decompresses a file. It can consist of two parts: an encoder and a decoder. For example, a common audio codec is MP3. When ripping an audio file to a computer, an audio program could use the MP3 codec to compress the file (creating a .mp3 file extension), and then when playing the file, the program would use the MP3 codec to decompress the file to be played through speakers.

Compression (audio, video, lossy, lossless) – There are many types of compression. Compression, as it is used in this paper, refers to the technical process of shrinking the size of either a file or stream of information. It can be done in two ways, either through lossy or lossless methods. Lossy compression takes a file or stream and chops it into packets which are then sent and reassembled on the receiving end (or in the file). In this process the compression actually singles out data that can be interpolated by a program and removes that data from the file or stream, which damages the quality of the information. An example of lossy compression is the file type .mp3. Lossless compression compresses the information, but retains all of it. It is therefore, not as efficient as lossy compression, equating to a larger amount of data; however, it retains its quality.

Compression rate –the rate at which a file or stream is compressed. Different types of compression can happen at varying speeds. For example, an .mp3 file encoding can happen at various rates, such as 128 kilobytes per second (kbps), 192kbps, and various other options. In this case, the smaller the file size, the more information has been removed.

ConferenceXP – Videoconferencing software compatible with the Windows operating systems. It is the ideal software for telematic art that only needs two channels of audio, as it is able to have uncompressed audio as well as high quality video.

Cybernetics - Cybernetics is a transdisciplinary science with roots in the 1940s that studies how people, animals, and machines control and communicate information. Cybernetic systems exist everywhere, and can be seen as intelligent. The system will follow this pattern: action towards achieving a goal, feedback on that action, evaluation of the feedback, and application of the evaluation to continuing actions.

Dark Fiber – Typically dormant fiber-optic cable currently in place as an infrastructure for high-speed Internet connectivity.

Diaphragms (large, medium, small) – A thin disk in a microphone that vibrates in response to sound waves, creating electric signals. The size of the disk specifically relates to its ability to accurately create electric signals for varying sound waves. For example, larger diaphragms are better at picking up lower frequencies than small diaphragms. Different diaphragm sizes are often used for different recording purposes by recording engineers.

Externals - Max/MSP objects created by users that are available to be added to Max/MSP, but exist outside the program.

Microphones (Dynamic, Condenser, Ribbon, Electret-condenser) – The different types of microphones mentioned all interpret sounds waves differently. In dynamic microphones, audio signal is generated by the way a conductor moves in a magnetic field based on sound pressure. Condenser microphones have better response than dynamic microphones because they have a more sensitive means of measuring sound waves, namely using a conductive diaphragm with a power source. When sound waves hit the diaphragm, it moves, causing a voltage variation. Ribbon microphones are older technology, and function by responding to the velocity of air moving a small ribbon suspended in a magnetic field as opposed to responding to sound pressure

levels like most microphones. Electret-condenser microphones function like condenser microphones, but without the need for an external voltage.

Frames per second – also known as frame rate, this refers to the frequency at which a device creates static images.

Frequency response – As used in this paper, frequency response refers to a microphone's ability to accurately capture different frequencies of sound. A perfect frequency response for a microphone would be if it could capture all frequencies with its range at a 0dB response (this would be a perfectly flat frequency response). This ability would mean that the microphone could perfectly capture all frequencies equally, without capturing any frequencies at a louder or softer response rate. The flatter the frequency response of any given microphone, the better that microphone is.

Gesmatkunstwerk – This term roughly translates to "total art work." Made famous by Richard Wagner, the term was used by him in reference to his musical dramas, in which he used multiple integrated art forms in a non-hierarchical way, causing each individual art form to theoretically have the same value.

Ground – One of the three elements of a cable: positive, negative, ground. In order for a cable to be balanced, it must have a discrete ground component.

Informatics – A branch science devoted to computer information systems.

Internet2 – A not-for-profit organization comprised of universities, corporations, education networks, governmental agencies and more. It is an advanced technology community with access to very high-speed Internet.

JackTrip – Software designed at CCRMA for routing many discrete channels of high quality audio between multiple machines. Currently the preeminent software for multi-site, multi-channel audio.

LOLA – Technology specifically designed for high speed audio and video transmission. The technology was developed by members of the Internet2 consortium. LOLA stands for LOw LAtency. This technology is very expensive and therefore unlikely to become widespread in the telematic art community.

Max/MSP – Max is a visual programming language designed by Miller Puckette. It has been released in the program Max/MSP by Cycling '74. The software program Max/MSP allows users to program and control sound in a variety of ways, including manipulating live sound in real-time. Today it has multiple applications, including programming capabilities, live sound manipulation, and live video manipulation.

MMORPG – This stands for Massively Multiplayer Online Role Playing Game. It is a communal gaming environment which has spawned many new technologies to facilitate interactions between players.

MUD – MUDs or Multi-User Dungeons, are precursors to MMORPGs. Originally appearing in the 1970s, they were typically text-based.

Multimedia – This term refers to content that utilizes multiple different types of content. In the specific context of this paper, it can be seen as modern day content that utilizes multiple art forms, such as television or movies.

Netronome – technology that functions as a synchronized online metronome allowing musicians in different locations in real time.
NOMADS – Network-Operational Mobile Applied Digital System, or NOMADS, is technology specifically designed to allow audience interaction in the piece *Auksalaq*. It functions in multiple ways: as a way to make sounds in specific parts of the piece, as a chat room, and as a way to convey information to the performers when necessary.

Phantom power – in the context of this paper, phantom power refers to transmitting electric power through audio cables (specifically microphone cables) to microphones that require voltage to properly function. It can also be used to power active direct boxes.

Polar pattern – A microphone polar pattern is the pattern in which the microphone is able to perceive and register sound.

Python – an old video transmission technology. It was incorporated along with RAT into ACCESSGRID.

RAT – this stands for Rapid Audio Transmission, and is an old audio transmission technology. It was incorporated along with Python into ACCESSGRID.

Simulacrum – a representation of something that is not actually the object. Simulacrum in telematics refers to the projection of a remote performer(s) into a different physical space. Simulacrums are often viewed as deficient or limited representations.

Skype – Skype is commonly used videoconferencing software.

SPL – Sound pressure level, or SPL, refers to the force of sound on an object. In this paper, it is used with regard to microphones and their SPL levels. If a microphone is hit by an SPL higher than its tolerance, it will distort.

Synchronization – In this paper, synchronization is used in two ways. The first way refers to the synchronization between audio and video. Specifically, this is a measurement of how accurately audio and video are linked together. The ATSC allows for a deviation of up to 30 milliseconds between audio and video with the understanding that the majority of people can not necessarily perceive a deviation of that size, or are at least able to still interpret the two stimuli as being linked. The second way synchronization is used in this paper is the synchronization between performers in a telematic performance. This refers to their ability to play things together at a

given point in time even taking into account signal lag. Technologies such as Netronome and Backstage are discussed in conjunction with this issue.

Telecommunications – In the simplest form, this refers to communicating over a distance. Commonly this refers to technology that is used for this purpose; e.g. Skype is a telecommunication technology.

Telematic – a term that combines two words: telecommunications and informatics. Telematic, therefore, means sending and receiving information over a distance using technology.
Telematic Art – Art that is created with three aspects in mind. It must use telematics, it must use multiple art forms, and it must include audience interactivity. This definition is taken from Roy Ascott, and his work "Is There Love in the Telematic Embrace."

Telematic Music – In this paper, telematic music is considered a sub-genre of telematic art that emphasizes music over other art forms. In common use today, it often only includes music, and no other art forms.

TELEnet – a public twin to the military ARPAnet. This network linked people in multiple cities through computers. It was an early attempt to network consumers.

Telepresence – the idea that objects are able to "be" in more than one place at a time. An example of this would be a machine operator on Earth controlling repairs on the International Space Station.

Transient – in microphones, this refers to their transient response. When a microphone registers a sound, it reproduces that sound digitally as a sound wave. A microphone with a loose transient response takes a long time to return to the baseline of the sound, while a microphone with a quick transient response simply registers the sound without it affecting any subsequent sounds.

TRS – Tip ring sleeve, or TRS, refers to a type of balanced audio connection. The tip is the positive connection, the ring is the negative, and the signal ground is the sleeve.

USB, Firewire, Thunderbolt – These are different computer connections. In this paper, they are discussed in conjunction with audio interfaces, and how the interfaces connect to the computer. They all function at different speeds, and in different ways, and therefore have different amount of latency and signal noise.

Videoconference – a meeting between two or more people in discrete locations in which they communicate by simultaneous video and audio transmission.

vipr – a program created by Benjamin Smith using Max/MSP for transmitting video over the Internet. It is highly recommended for use in telematic performances.

VOIP – Voice over Internet Protocol, or VOIP, is a method for taking analog audio signals, turning them into digital data, and transmitting them over the Internet.

World Wide Web – a platform people use on the Internet. It is an information system of documents or pages accessed through the Internet.

XLR – A type of electrical connection used with sound equipment. In the audio world, XLR cables are most commonly found as connections with microphones. An XLR audio connection is a balanced connection with each of three prongs having a signal component: positive, negative, or ground.

APPENDIX B: INTERVIEW WITH SCOTT DEAL

MC: What made you interested in telematic music?

SD: Sure. I have a life-long interest in technology. And even when I did my doctorate, I remembered thinking, what are the issues I'm bringing here? I really want to get solid with whatever technology offerings are in percussion because I like the electronics. I like all that stuff. So I was drawn to it and did a bunch of stuff, and then when I went to the University of Alaska, I was always integrating electroacoustic and midi in my performances as much as I could. Even in 2000 I played a showcase concert, not an entire one, but like a half concert.

So at the university, people were quite aware of this, because it was a small place, and so the supercomputing center reached out to me, and they built this lab that they called the discovery lab. It had a gigantic cave environment, which were three huge screens that could either be folded out flat so it's a massive thing, or the two sides could be folded in, then you're in a room. And the floor was a screen as well. And then they also had high bandwidth Internet, Internet2. And so they showed me this room and they said, "What do you think?" I was like "Wow, that's amazing!" They said, "Well do you want to get involved with it? Do you want to use it?" I said, "Yeah, but I don't know what I would do." They said, "Well, you know, things will come." And so I was thinking of stuff and then, through their cooperation and they had information about what was going on, they said, "Well, there's Internet2." This was late 2002. There are people starting to do stuff using the Internet.

So I followed up on their leads which led me to a group working out of the University of Utah. The names of the people were Jimmy and Beth Miklavcic, and they played a crucial role in me getting an understanding of this and getting involved. They had a performing arts company that was tied to their supercomputing center that they created. They were recruiting people and talking, we can do these Internet things. And were using the ACCESSGRID software. It requires very high bandwidth, but it's like really amazing. It's kind of archaic and old now, but it was cool back then. And so this consortium started, like an informal consortium, that we decided to call ARTGRID, in reference to the software, which was called ACCESSGRID. So ARTGRID came up, and that made it palpable for those of us who were professors who were getting involved that we weren't just doing something for this little company. That it was a consortium, that it was understood.

So, from 2003 to 2007, we did about 5 really involved performances that would take months and months to put together. And some of the universities were University of Utah in Salt Lake City, UAF, University of Montana, Charles Nichols who is now at Virginia Tech, and who has since then built a quite reputation of his own as an electroacoustic artist composer, and he's a fabulous violinist. A couple British Universities, University of Leeds, I think. And I'd have to go back and look, but they had contacts in England, and people in the UK were very interested in this stuff. So we got Ryerson institute in Toronto. Rensselaer, I think, engaged with us once; Stanford, their whole Carmen thing, one time we were participating with them. They didn't do an ARTGRID thing, but we worked with them a little bit. So anyway, there was a small group of people across the planet accessing this thing. And so, we did productions.

But that for me was my education with all these things. I had chops with midi and a little bit with computers, but I had nothing with Internet.

But the supercomputing center, they were really interested, through our association, they were interested, they were working really hard back then to get supercomputing, what they had to offer, into **all** components of the university and they were really focused on science and engineering. But they wanted to also have some, "Well it works for this, too! And it works for this, too!"

So here I was, engaged and, could really bring something to the table, and so they were like, "You're one of the people we're going to seriously invest with time and energy, and money," because I told them. They said, "We really want you to do this stuff." And I said, "Well, I need help." I remember talking to the director of the supercomputing center, and we had a meeting. And he said, "Well, what do you need?" And I said, "Well the first thing is I need is to start going to some conferences so I can learn how to do all this stuff." He said "You're going." I said, "Well secondly, I need help. I don't know how to operate in this and that." And he said, "We'll have faculty and staff. We'll have staff there to man this discovery center." So it was a stroke of good luck timing. It was a lot of money being invested.

Now, when I was there, the supercomputing center had like 120 employees. And they were operating all throughout the campus. But it was **all** federally funded. And there was even a big war with the university. I remember the whole time I was doing it, they knew that the money was going to go away eventually, and they kept trying to get the university to embrace it and to take it and make it part of their own. The university was always like "no way." And so now it's got like 10 people on staff. It's a shell of what it was. So it was good timing. I was there when there was all this money, and they wanted to do all these cool things. And, you know, I just happened to be a beneficiary of that. So through that, this staff, they would operate the ACCESSGRID software. And my role would be to say, "It sounds like shit. Can we fix this? No, you need better speakers, no you can't use those speakers, look, it sounds like a radio." That was my role to tell them what was going to be good and what wasn't, and also to come up with ideas.

And so I worked with these other artists and this married couple Jimmy and Beth. Actually they were the employees of their supercomputing center.

Most supercomputing centers in the country have kind of like been way cut back now. It was a thing of the 90s and the 00's. Now it's like, you know, now it's been replaced by Information Technology Services at various universities. Where now it's much more of a service-oriented thing. But when it first came out it was very sexy and all this other stuff.

So when we were giving these productions it was easy for me to get educated because I would be there and hands on the gear and start learning these things.

So we did all this stuff and I started giving presentations about our work and some of the things other people did. But all the while I also realized very quickly, it hit me the first production, that this is like, incalculably amazing. You know, the idea that we can create art, I mean I felt like Christopher Columbus, I seriously did, just staring at the shore, and this is a whole new

continent, I can't believe it. That's how I felt. And so I immediately knew it was going to be a big part of the rest of my career because I just thought it was so important. That you can, all the ideas you can do. Countries that don't like each other, if you have artists that start communicating via the Internet, that that can be a bridge, or tying cultures together. Or bringing people together for whatever reason, which was the whole basis for the opera. The Internet could be very powerful, and also that the research part of it or the thing to really learn is that it's also a **new** media. It's not, you know, some people, and I started reading about all kinds of people trying to do things on it like this one you see, like someone playing jazz vibes, you know soloing while a jazz band in a classroom is playing or a jazz band in a concert, and then they have their vibist on the screen. I always thought that will never last because that's just trying to sort of use all this beautiful technology to do what you're already doing.

You know, no, let's keep the jazz vibist with the jazz band, that's a better choice. But I knew that there were people who had to figure those things out and had to test this stuff out and find out what works, what doesn't work. Sort of like pull out and help grow, like weed out the bad stuff and then plant and fertilize and let the new things come up. And treat it like an entirely new media, and so I just thought, I'm just really going to work on this. And so I did those 5 ACCESSGRID, and I played on a lot of them. We did some things. We did real time fast playing without a click, Charles and I did, we had dancers, we had media, we integrated music, we sent MIDI messages, machine messages where someone would be playing something that was being controlled by another. We did all of that stuff because there were all these people that were like "hey, I got an idea," and we'd have meetings. We'd meet like once a week for months and plan out something and then we'd have a schedule and meet daily, it wasn't like we were going to get travel, you know, so it was actually quite good.

And, to be honest, also, I was interested in it because it gave me, you know, I was at this little University you know up in Alaska, which was like 10 billion miles from everybody. And getting anywhere else was really tough. And so I didn't get to get out very much. So this gave me something I could sink my teeth into and keep life interesting for me, so I would do my percussion stuff and keep that running really well, but then the fun thing for me was to go to the discovery lab and engage with these other artists, photographers, videographers, dancers, everybody. And come up with these really fantastically cool productions that we would then stage, and it was just wonderful! So, and then I produced, but I got tired of it being just this couple; as much as I liked them, they always called the shots. It was always their title, it was just for me personally, too much control on their end; you know I want to do my thing, too. So I started producing a couple of them. I produced a play; it was a David Henry Wang who's a Tony award-winning playwright in NY. He wrote this, it was very…And I worked with our theater professor…

This theater professor, we, she, you know, I said, "I'm looking for something only one or two actors that we could do on the Internet and that we could use the whole cave environment. It was a beautiful play and we got her artists and she did all of her scenery. It was all using the cave environment. So it was like a super-high-tech thing, it was like a group play, got you all choked up, it was really cool.

So I did this stuff, so one day, I just got a call, you know, in 2007 from IUPUI, and they explained who they were. They said, "Okay, we're down here. We're sitting on, we're sitting on top of, we're **the** hub for Internet2, and we want, we've seen your stuff, we want you to come down here and do it." I was like, "I'm coming!"

And then when I got here, suddenly, ACCESSGRID was just about getting to the point where it wasn't hip to use anymore. But once I got down here, suddenly I didn't have that wonderful group of people to help me, so I had a big learning curve; like I had to start making it happen myself, I had to get funding, I had to get the gear and all that. But then right after I left, back to this money thing, but right after I left is when the money went away. And people started getting fired and laid off. And now they don't even have the discovery lab any more. They disassembled that giant thing. They passed off pieces of it; they pieced it out to other departments. It's gone. Everything's gone now.

It was like there was this window of opportunity there in Alaska, and then it went away. And it's just like I got out just in time, unknowingly, but that's how it worked. And so, that's basically the answer. Very short question, very long answer.

MC: So can you just talk about, well, maybe just list some significant performances or conferences that you presented at or played at?

SD: Oh sure. Well the ACCESSGRID stuff. Well, the thing about telematic stuff is that a lot of times it's not going to be at a conference. But yeah, we've done SIGGRAPH. Which is always huge. We did a whole play at SIGGRAPH. College Music Society was a big one we did, that was Artgrid, not this company. Another Language—the name of the company, Another Language Performing Arts Company. That was their company. But through them and my associations with other people led to a lot of different projects. So then University of Florida has this thing; it's like a little research institute like I have. James Olivera, he's the head of it. And he got a keynote conference presentation slot at College Music Society to demonstrate Internet music and asked me to be involved. And what he introduced into the mix was this software called Netronome, which was a synchronization software where everybody could be playing on a click. And then the one venue that would have, the performance, like the audience, all the feeds come in and then they were buffered.

MC: So they would synch up.

SD: So they'd synch up. And then they'd have players there. So I was actually one of the players there. But then we had a group at the University of Alaska who was playing. And he wrote a piece. He's a composer. He wrote a piece to record in South Carolina. And then there were some at University of Florida. So this was a big deal at CMS. You know it was CMS ATMI, so it was a big deal, and this actually, that was one of the ways I got this job. Because people here were at that conference and they saw me. And so I think that's when I started getting their attention there. So that was a big one ATMI CMS.

I gave a clinic at Percussive Arts Society in about 2008 where I introduced some telematic elements that had to be just wireless. It was very minimal because they don't have the thing but people at least got hip to it.

There was an article I think that was rather important that I was able put in Percussive Notes back in the early 2000s called percussion, or Internet2 percussion. And then also I presented at several Internet2, instead they don't call them conferences, they just call them member meetings. So by the time I got to IUPUI, I had pretty much made the rounds with the major conferences.

MC: Okay. What other efforts have you made to promote telematic music? So you mentioned the conference presentations and PAS and things like that. What else have you done?

SD: Well we'll get to the opera I guess.

MC: Yeah.

SD: I just work at it every day. And, it's just the long line of a bunch of little things. And so I've done all kinds of, once word started getting out about things to do you get asked to do other things. And so some of the more memorable ones, I'd say one of the most satisfying ones I ever did was in Alaska. Where Jim Olivero, where based on the, building on the success of his conference thing, he wanted to go back and do something else, and so he got involved. This was so cool. It was a conference on native culture at the University of Florida. But it involved both the Americas, and so he wanted to have a scenario where these various native groups could talk in their language and perform their own music with, in conference, like, online, with other groups. And so he asked me, he said, "You know there are a lot of Alaskan natives, and would you like to do this?" and I said, "Yeah." And so we put that together. And it was actually quite difficult to get these groups to agree because understandably in both South and North America, natives, people of native heritage are very suspicious of scholars and people in the government because they've been screwed over for hundreds of years. Right? Their reaction's not just no, but sometimes they're a little like abusive, you know like, "Are you kidding?" and then they start taking out their frustrations. And so, and actually I experienced that with a native studies professor. He was like, you know, "You guys just always, blah, blah, blah." I said, "That's really not what this is, this is really for you guys." So he decided to go ahead and do it, and then it was such an amazing experience because there was a native drumming group on campus that they do native song and drumming. That's what Alaska's music is, this drum and dance and singing. And we got them in the room, and then they were talking in real time with groups in the States but then also in South America, and it was like the most wonderful experience in the world. They were all so excited, and the other groups were, I mean it was very emotional.

So many things like that that would just come up. I've just been involved in it. And my first couple of years here even at Another Language, we did some things with England, we'd do them out of the lab. So I think it was just the kind of thing, once you get up and running and you're out there and people know what you're doing, then you just start doing many mini projects.

I think my website, The Telematic Collective, and also, yeah, The Telematic Collective has a bunch of stuff on it.

MC: What do you think are the limitations of performing telematic music?

SD: That's really good. Financial is the first one, because you need to have access to high bandwidth. And you need to have gear. The second one is the fact that it's new and that no one knows what it is. And so, when you're talking with people about it, they don't really, even once they start understanding it, and they're telling you what they understand, a lot of times you think, "Well, that's not really what it is."

And so, I'd say, those two, you have to work through. You've got to get funding. In fact, when I talk about this, when I give presentations, that's always one of the main things I tell people you have to do: if you're going to do a good job, you also have to take into account finances and you have to get someone on board who will help you find the money. You just can't do it like, "Hey, let's buy this piece of percussion music." And work it up and go present it. It won't work. You've got to find money.

MC: Will you describe the current state of telematic music as you see it?

SD: Yeah. Well, it's getting better all the time. Telematic art, people are learning how to do it. And, it hasn't caught on universally yet, but it's growing, slowly. There's more people doing it right now than there were. This is 2013; I've been doing it for exactly 10 years now. Pauline Oliveros, I would say is the pioneer, for this generation. Roy Ascott was a writer, is a writer, and he's in his 80s also in England. He was talking about this stuff. So there's a generation of people who saw the concept, and there's another generation of people who started doing it with very, very, very limited resources. And I would say Pauline stands out because in the very beginning of that, it's in the 90s. Where she first started out, I mean people actually in the 60s, but those people I would say is a disconnect; that was before we ever had the capacity. But telematic art started with people sending, using Telex machines to send stock photos. You know, where it's like a photo and then 16 minutes later another photo and then and 16 minutes later you know a camera that just takes a photo and it makes a movie that's basically when you see it, it looks like a Xerox of the photo. That was when people first started using telecommunications for art was for these things.

But Pauline, back in the 90s started using very very limited little teeny bandwidth to send messages. And to, I mean, she should explain more of what she did. And there, that really developed as the bandwidth grew. And suddenly, you know, I remember in the 90's, suddenly it was, "What a concept, I can take a photo and send it." I remember thinking, "That's a new idea. That's really cool." Now we're just like, it's part of life, isn't it?

MC: Yeah.

SD: And then you could send music. And then, suddenly, you could do it live, and it wouldn't sound like it was over a phone line. So each step as it got better, more people got interested. Now I think that it will never be a mainstream thing. Like we'll never have a PASIC of telematic music. Because I think also people have learned to use the Internet to continue to develop regular kinds of music, regular kinds of art using the Internet. And I think the Internet's very useful. But the pure, like, this is Internet music, I think is always going to be a niche thing. But I think it's an

important one. But I think it's healthy, I think there are more programs. And now, I would say, that any major university, research-based university that has a school of music that also has a serious music tech, music, like computer music component, like an electronic music studio or a professor of electronic composition, any kind of element like that, that they are people who are also interested, either they are doing telematic stuff, or they would do it given the opportunity. Those people all know about it now.

And so for instance, Michael Gurevich, I wouldn't say his forte, he wouldn't tell you his forte is telematic music, but last year when we decided to do this, we'd already worked together a little bit, or I'd been on one of his conferences and we'd gotten to know each other, and so I said, "hey Mike, I know you have great players in Michigan, we're going to do this thing, are you interested?" He was very interested.

So I'd say that's where the state of it is now. It's growing, more people are interested, more people know about it.

MC: Very cool. Do you view the ability to capture a telematic performance for later dissemination as an important reason for performing this way?

SD: No. I think that in fact, let me go out on a limb and say that I don't even like the idea of streaming a telematic performance. In fact, it was a point of contention between Matthew and I on the opera. I did not want to stream the telematics performance just for people to look on their screen. I feel like that, that's like saying, "You really ought to check out this restaurant, it's amazing. Here's an hors d'oeuvre, a day old hors d'oeuvre, that'll give you a sense of how amazing this place is." And, it's like, well, it's tasty, but if you go to the restaurant, then you get the whole experience, the lighting, the people waiting on you, the quality of the food, the ambience. This is a great dining experience. And so, I think the streaming thing. And actually, if you look on our website, there's, the only times that there's streaming that people can go look at movies, I do it for the benefit of the students for their own personal works that they want to put up there.

But I don't find a lot of use for it because I think it's more important to go into the immersive environment where it's already media enriched, you've got screens, you've got the sound, you have live flesh on the stage. Because telematic art to me is a combination of live flesh and Internet. It's not just Internet.

MC: Okay. And then lastly, before I move into asking you specifically about technology. Performing telematic music necessitates a different relationship between performers. Does this changed relationship factor into the outcome?

SD: yeah. It's, and this is, you're touching on here, this is one of the big meaty areas to look at.

The broader question: how are we as humans going to, to develop, you know, what is going to come about as a result of this virtual relationship building? What are the dynamics? You know, we're social creatures. Obviously. We're more like ants than we'd like to admit. You know, we, we exist as a species. No one lives alone.

MC: Sure.

SD: And no one does anything alone. But this Internet is brand new. And it's definitely going to change the way we do it. And also we have definitely not figured out how to do it online yet. It might take a couple hundred years before there's things that are now established as humanity, you know, like what are the best ways to do this, and you know, I think it's going to have a transformative effect. We're in the very early stages. And so the question is, how is that doing that?

MC: Yeah, how does this changed relationship factor into the outcome of the performance?

SD: So I think that, Pauline Oliveros told me this, the very first time I met her. It was the very first thing she said to me when I sat down next to her. I went to her studio. I called her, I said, hey, or I wrote her and said, "I'm going to be in NY, I'd love to go up to RPI and see what you've got." And she wrote right back and said, "Yep, we have rehearsal that day. Rehearsal's at 4; why don't you show up for the rehearsal?" So I came in, and it was a small room, not much bigger than this. And she was sitting at a table and she said, "Oh Scott, come on in, have a seat, you know." She turned to me She just said, she goes, "You know, relationships are what this thing is all about." [laughter]

And I was like, she's exactly right! It's still, you know, even though you have technology it doesn't let you off the hook. That it's really about cultivating relationships that lead to these kinds of performances. And so you're not seeing the person, but you're seeing them on the screen. You're not shaking their hand, but you're, you know you're emailing. And you're also, like when you're talking, you want to make sure that you know you have the ear bud so you're not have to have the echo. Having an echo is embarrassing, because you haven't taken care of your gear. You're thinking, can you fix your situation.

So, I'd say that it just takes every bit as much effort relationship wise as not using the Internet. The Internet is not a short cut for relationships. What we're finding out, the big dirty secret is: You still have to pay your time and energy investing in relationships. And it's a revelation. Does that make sense?

MC: What programs relating to video have you used over your telematic music career?

SD: Well, obviously, ACCESSGRID. ACCESSGRID was developed, this is interesting, it was developed at Argon Laboratories in Chicago, or outside of Chicago. It's a big federal think-tank. Federally funded. They were given the mandate by whoever their bosses are. You need to develop a software that can be used for large-scale, massive scale conferencing, video conferencing, both audio and video. And their idea was that you have conferences with hundreds of attendees and they're all in the ACCESSGRID. And they have a big enough screen, there's all these boxes, they can see each other. In fact, I have photos of them; it's like 40 or 50, you know. And so they came up with it as JavaScript. It's old, it's archaic. They, actually what they did was, they stitched together, oh, and the other requirement, the federal government's like, "**And**, you will make it available free to the citizenry of the United States." Free of charge,

downloadable. This was back in the 90s they did that. You know. Develop this, make it free of charge. Isn't that fascinating?

MC: Yeah, that is.

SD: I mean you know, there's people in the government, I mean we bash the government all the time, but there's some very forward thinking people there. This is before any of this took off. And so, but what they did was, they found these two, Python and the other's called RAT, Rapid Audio Transmission. Python's video transmission. They stitched together Python and RAT. With less than fun results, but it was effective. And the engineering and science community used it for a long time.

Now it's been replaced by really large companies. Adobe has a menu, a suite, of various applications that do these kinds of things now. Adobe's probably the leader in it. They have Adobe Connect which is a classroom thing. They have Movi. And they're all really more for conferencing than for art. There's precious little for art.

The ACCESSGRID, I think there's still a website for it, and it's really great. And then, there was actually even a company that spawned out of, they took the ACCESSGRID since it was free of charge, and you could use it freely as a citizen of the United States. You know your tax payers, tax dollars are paying for it, that's why it's being free, the tax dollars were paying for it.

So what was the name of that company, I don't know, but they, they were the ones, thy dressed it up and made it nicer, made it all fancy. And that's what we used for that CMS conference. But you had to pay them a licensing, expensive. So Jim Olivero had to like pay them a license to use it. And that's always the death knell for Internet related apps. You know, if it's more than two dollars, no one's going to use it, right?

MC: Right, right, absolutely.

SD: If you charge $150 for something, you're not going to, one person's going to buy it and that's because you talked him into it.

JackTrip is fundamentally important. JackTrip came out in about 2005, I think. Chris Chafe at Stanford developed it. He and his partners, or researchers. It's the only thing right now that's really great for multi-site, multi-channel audio. It does 16bit multi-channel audio over the Internet.

MC: Can you give a short description of how it works?

SD: Yeah. What it does is JackTrip works because it takes the audio routing, the reason, and it eliminates a lot of the latency, and it also allows you to send, you know get more bang for your buck, in your how much bandwidth you have because it bypasses most of the processes in your computer. So yeah, when the computer gets the thing, it sends it to various routing things inside of it. And by the time it gets to you, many milliseconds have gone by, and there's also a lot of packet loss, and there's also quality loss. So when you're talking about multi-channel, you've got

a lot of channels coming in, so it actually bypasses much of that and goes directly where it needs to go to. And it's a smart piece of software, and it's going to be around for a very long time. Anyone who's serious about telematic art, they have to get solid with JackTrip. There's no other thing right now.

ConferenceXP. Fascinating story with that, too. ConferenceXP is high end video conferencing software. I'll give you the background on it. Microsoft developed it. They were developing it to get in the game with Polycom and Adobe and Tandberg, right, the high-end video conferencing people, like the president of the United States probably either uses Polycom or Tandberg. Right, when he's sitting in a meeting with his generals in Iraq, you know, you see them on the screen and there's a camera, a big TV screen camera, that's vintage classic Tandberg or Polycom.

Right, so Microsoft is going to get into that game. And then they decided after they developed ConferenceXP, that no, we're not going to, but they'd already built it. And so what they did was they cut a deal with University of Washington. We'll give it to you. You have to make it available, free of charge, to the public, **and** it has to be open source. You know you've got to open up all the keys, so people can play with it and dink with it and research with it and develop it. Massively, right, massive, like across the Internet. Of course the University of Washington did. You can go to the University of Washington website, and you can download it for free, and it's great. It's also really high fidelity audio. But it's **only** stereo. It's only site to site. You can only send a stereo signal. You can't like have a mixer full of things and send a whole bunch of channels. It's just stereo from your site. So that's the drawback to it. But the upswing to it, what JackTrip doesn't have, it has no video. JackTrip is only audio.

So what we had in the early 2000s, well, like 2006 to even now, you have a lot of these like Stanford, RPI, UCSD, SARC, the whole ICMC crew, what they've been doing for about 10 years, is their standard modus operandi, is they use JackTrip and Skype. They don't care about the video. They never have. They're concerned about the audio stuff and really high fidelity audio. And I've always made the argument to them, I've presented different things. I've been in conversations with people, it's like why don't we beef up the video? They're like, "Well, I don't see a real need. Why would that be important? This is music." I'd be like, "No." This is my argument. And I, for years now, I've said this. Telematic is not telematic music, it's telematic art. If you just do music, you're missing the point. The point is that we're creating a new art form that's media: audio, video, live people. It's not movie, it's live. You've got to have live flesh. You have live flesh in the environment. But you need to have media, so you can also integrate videos and mixing and Jitter and all that stuff. Well, with ConferenceXP and a good video switcher, you can do that. But since they're just musicians, they never wanted to go there. So there are several schools. So there's Skype, JackTrip. Now, and what I've pushed with people is JackTrip/ConferenceXP.

But now, we're developing another one at IUPUI, with our new professor Ben Smith, and it's called, and actually I gave him the name, it's called vipr. And I know it sounds like a car, like, alarm system. [laugher] No, actually, he came up with the name. He had it, it was called, he, so basically what it is, it's like JackTrip, but it's video. Alright, and it's a Max patch, I mean it's a very bare bones thing. But it's good, solid video. But then you've got to combine it with some kind of audio. Actually, it has audio, but it's only stereo. It was called, here's the name he named

it: UIUC.jit. [laughter] Which was, he was, did his doctorate at University of Illinois Champaign Urbana, right?

MC: Right.

SD: So UIUC, Urbana Champaign. And so, and he was and sort of, I've known Ben since 2007, and he's in his mid-30s, so I've kind of mentored him a bit. Or he's come to me like for advice and things like that, and we've worked together, and he's a brilliant young man. And so I remember suggesting, he was asking about it, I said, "Well, look, you want to go mainstream with this, I would definitely change the name."

[laughter]

I said, "You got to give it a name that people will remember. I said, "I've struggled for two years, is it UIUC, or UIIC, or, what, what is that name anyway?" And he was laughing, and he said ok. So he came up with vipr which was video, Internet, protocol, something, I mean it's V-I-P-R, you know. I was like, that'll do it. And that's what I was thinking, isn't that a car alarm system? [laughter] But its vipr, and it's new to the scene. But we used it.

We started with ConferenceXP, but that's it, ConferenceXP hasn't kept up, and Michigan was having trouble formatting it. And they were having trouble getting through their computers inside. This is technical problems you end up all the time. They, you know, they're all mac users, so they have to go like get PCs from the university. And then the PC has like an internal firewall, and then you can't change it, you can't go unset it because you can't get into the administrative settings. And so then you have to take the computer back, and then you don't want to do it. And so they were having tremendous problems. And I hadn't even thought of us all using vipr, but I'd already said, the other thing I didn't want to change so close to the conference, but then, Norway couldn't get it figured out. And Michigan couldn't, which shows you how hard this stuff is.

Norway, they knew the stakes were high. Peter Cates, he's been a member of PAS for a long time, he's the principal percussionist of Bergen Philharmonic. He knows it's serious business to present at PASIC. So that's when I went to Ben and said, "We should do this." He said ok. He just spent a lot of time working with those two groups and got vipr. So we used vipr very successfully.

So JackTrip, ConferenceXP, vipr, ACCESSGRID. Some people have used Skype for things. Skype, if you're just using the audio and the video and that's your telematic thing, it's a joke.

And then one last one has been that I would mention is this thing that the Internet2 people have pushed very hard, and I'll have to send the name of it. But it's ultra, ultra, ultra fast. I mean, it's greased lightning fast audio and video. So fast that there's almost zero latency. But the problem with it is, first of all, the video is so fast because it's black and white. And then the other challenge with it is you have to spend 1500 dollars just to get the camera.

And you have to do all these, in other words, there's all these things in front of you that you've got to take care of, and then you have to have a special line between you and the other site where

they've already booked, you know with this Internet2, with this high bandwidth Internet. Sometimes you can get this really great 10 gigabit connection, this flawlessly fast, and I've seen those demos, I've been to conferences in California, and Washington, all over the country, you know, where they demonstrate it. Months in advance, they line up the bandwidth, they line up the connections, they book them.

MC: Okay

SD: So they've got a direct—there's no routing. Like if I send you an email, it goes here, there, it goes to Europe, it goes to South America, it bounces all over, and then it gets to you, right, it's one of these routing things.

MC: Right, right.

SD: And who knows how that works; I don't know how. But to get the speed, you've got to go, you've got to cut through all of that, you have to go point to point. If you're going to do that, you have to have the money, you have to have the administrative connections, you've got to to book it. So this is the, LOLA, that's the thing, low latency, but LOLA. Northern Illinois has a department chair of the school of music, head of school of music who is really enchanted with Internet2 stuff, and so they've invested in LOLA but I, my prediction is, it won't get to the mainstream of telematic people because of the hurdle of you've got to drop 1500 bucks, it's black and white. There is a color version, but that camera is five thousand dollars.

So, and there are other things like that, there's Netronome, there's things that crop up that are a really good idea and kind of do something way better than the rest of it. But it's like, it doesn't fit into the pragmatism, it's like, when did the car take off? When Henry Ford figured, did the Model T. Suddenly you had an inexpensive, reliable thing. Before that, a car was very exotic, and it didn't work a lot of the time. The light bulb, when did that become, why did Thomas Edison, other people were figuring out you could do that. He was the first guy to figure out you can do it, and sell it for a dollar so everybody in the world can use it. So with telematic stuff, I think the only things that have staying power are the things that are inexpensive, and maybe they're not the very best, but they do a damn good job.

MC: So then, if you were to rank them as far as your top choice, second choice, third choice, what would they be?

SD: I would recommend right now the combination of ConferenceXP, because ConferenceXP you can have as many people online as you want. It's just you go in the chat room, you join, then you have a window. And everybody, people can click your window as full screen, or they can have all the windows on the screen. It's just wonderful. So I think right now the most potent combination given that everyone knows what they're doing and everyone's invested, they are going to put the time and effort, and they've got the facilities, ConferenceXP and JackTrip. Coming up fast, JackTrip and vipr.

MC: And is vipr available to the public yet?

SD: Downloadable. Free. Ben Smith's website.

Then there's other, then also what I would recommend is a piece of software that we developed here at IUPUI lab called Backstage.

MC: Okay.

SD: And Backstage, so there's, a there's a clock, a common clock. I believe it's in Oslo, that covers, everybody's watching the exact same time so it's exactly synchronized.

MC: Right.

SD: You can put cues in it. It's completely a web app. You don't have to download anything, if you have a link. And then there's someone who is going to be the server, who sets it, is the host, and everyone else joins most of the time. So you can put it on your iPhone, iPad, any kind of tablet. So you can have it sitting on your music stand. And you can be ready to play, and then a cue will come up, "Scott, perform now," or "start now." So it's an incredible cuing system, and the other thing again—it's free, you just use it, right?

MC: Right.

SD: There's nothing tied to it. You can set is up and use it yourself. You can synch as many people as you want, you can have the cues, you can, there's a texting thing, and so it's for the people running, like our little console people. Each one. Once the performance starts, you can't like get on the phone and be talking. You can't be talking into a microphone.

MC: Right.

SD: So there's a texting thing. So you can text, "Oh we're having trouble with your connection, we just lost you," or whatever. So people can be in constant contact and your name comes up. It's just fantastic. So I would recommend anybody if they're going to do a large telematic thing, they've got to have some way to, for people to be, and that's why it's called Backstage. It's the back end, where people aren't going to see, but you have to, you have to do it. And so for the opera, we had everybody was on backstage. And the opera guys were talking, but, and then the musicians on the stage were, were doing it.

MC: So you've got ConferenceXP or VIPR for the video, and then JackTrip for the audio and then this would be logistics basically.

SD: And coordination, yeah.

MC: Based on what we've just been talking about, is there a preferential operating system, or since JackTrip is a Mac thing, how do you run that and ConferenceXP at the same time? Or how have you kind of gone through these issues?

SD: We've done ConferenceXP with Mac based computers that, you go over in boot camp.

MC: So are you dual-booting?

SD: Yeah, you dual-boot. Well, you've got to use two different computers.

MC: Oh, ok.

SD: You could not use ConferenceXP and JackTrip on the same computer.

MC: Ok, so they're just multiple…

SD: Multiple computers, Yeah.

MC: Okay. What technical problems are there for performing telematic music? Like what are kind of the categories?

SD: Yeah, um. The Internet should be viewed by anybody who wants to do this stuff with fear and trepidation.

MC: Okay.

SD: It is, it's a dangerous world out there. The Internet is unruly, it's unpredictable, it will punish you. Okay. We experience it all the time, but we don't think about it because the stakes aren't so high. When you get on your computer, how many times you can't load up the window? How many times does it happen where too many people in your apartment building are trying to download movies, and then some of you are knocked of the Internet? How many times do people get hacked?

And so a telematic performance is fraught with danger of, the danger of getting through it smoothly without technical glitches or without screen artifacts showing up or without the audio clipping out or without it starting to sound jittery, because like even in JackTrip if the bandwidth starts… you know, I think of it as an ocean, oh the ocean, the beach is so nice, it's sunny out. Yeah, but, there's sharks out there; if you swim out too far, you'll get pulled under by an undercurrent. If you drink too much salt water, you're going to die. You know, it's going to dehydrate you. I mean the ocean is actually a very dangerous system. I mean it's life-giving, we come from the ocean, but it's also a dangerous thing just to kind of go play around in. If you take a sailboat, you darn well better know what you're doing. Or else you're not going to, you'll get lost and you'll drown or be adrift until you die. It's not to be toyed with, and that's how I look at the Internet: that there's all these things that if you're not keeping your attention to or not, or creating, okay, what's plan B when this happens, if this happens, how do we nail it down, how do we take care of it? And so, I'd just say there's a lot of it. It's just you have to have all eyes open. And get used to, you know, so I've listed: packet loss, screen artifacts, audio, I don't even know what the word, but just packet loss with the audio which results in [demonstrative sounds, inaudible] you know, like, people's voice starts sounding like they're breathing helium. Which is, I mean I kind of like it, but, but most people think, oh, there's something wrong! Yeah, it's the Internet, but it's kind of cool. It's like, this is telematic, you know, but I find that doesn't sell very well. [laughter] But that's a whole 'nother philosophical discussion. And it actually is much

deeper than telematic art, it's the whole, I mean, you know the whole glitch movement, you know the glitch?

MC: Yeah.

SD: That's what we're talking about. And the glitch movement is they've decided to start making art out of that stuff. Right? Or like making it that's as important as anything else.

So that's how I'm coming at telematic art from that kind of informed perspective, that this is a new medium, and this is part of that new medium that these things are there, and that our technology doesn't just clean them out. But people who come who are just used to listening to chamber music in university halls, that stuff annoys them, and so I'd say it's more of a social battle, or it's at least equally a social battle as it is a technological battle. And the battle, then you get into the philosophical question, which I fight it all the time: Do you want this to be a medium and accept it for what it is, and let it develop, and extract things, or are you trying to make this you know, your concert experience that you're used to listening to and seeing. And my argument is your concert experience has 10,000 years of development. You know, 6,000 of which is recorded history. People speaking in spaces, learning how to make that sound good. That's why you can go to like the Acropolis, which is an outside theater, and they figured out if they shape it a certain way, that people way in the back can hear it. This is 10,000 years; 20 years. There's a lot of stuff in there. And that's always my argument, but people still don't like some of these elements.

MC: That's a really great way to look at it. Alright. Let's jump to Internet2, and just give me a brief interview of what Internet2 is.

SD: Sure, yeah, yeah. Internet2. Because that's a good question. Because I was always confused. I mean, I was in it for a couple years before I finally figured out what it was. [laughter]

MC: I have the hardest time trying to explain it to other people.

SD: People think that Internet2 actually means a new kind of Internet. Internet2 is nothing more than an organization. Formed around something that is kind of important. What it, what took place in the 90s and going into the 2000s, is that governments and also really large corporations like, you know, Microsoft, or the, the media corporations really, we're not talking about developers, we're talking about media corporations. Some of them, you know, they don't even want the public to know what their name is. And that they have billions of dollars in holdings, right. And they control a lot of the media we see on TV. Okay. Especially the ones that deal with sending broadband to your house. Those companies have quietly invested for 20 years in building a new infrastructure, and they've laid cable. And then there's also companies that they just are the cable you know, they lay the cable. So they've laid cable, and have you ever heard of last mile issues? Do you know what that is?

MC: No, I haven't.

SD: I'll explain it. They've laid the cable, these big, fat, fiber optics, because that was also back in the 90s a fairly new way to start doing it. So they've been laying fiber optic cable. And then once it's laid and it's hooked, it's not hooked up to our homes or the institutions, but it's laid in the major routes, and they spend billions of dollars, Europe, North America, a little bit in South America, certainly in Asia, certainly China, Korea, Japan, not so much Japan, but certainly the mainland of Asia. Australia. They laid it, and then it's sitting there dormant. And it's called dark fiber. It's called dark because it's not being used yet, or it's being used very little. This fiber, now they have fiber capable of connections of 100 gigabits per second. It's unfathomable.

For a while, the standard was 10 gigabits. And actually our lab at IUPUI, and this is what they lured me down with and said, your lab will have a 10 gigabit connection. We have a 10 gigabit connection. But especially the whole building doesn't have that, but I have that. But even then I have to book it, but it's understood that I get it, and they've already put the stuff in the wall where I can have it, but I can't just turn it on. Usually it's 100 MB, but if I say I've got a special thing, I need the 10 gigabit, then they'll clock it in, right, because it costs them money.

These companies laid it knowing the future that they would reap; it's an investment. They, just like when people built the railroads. You know. It's like the next building of the railroads. So Internet2 was established as a consortium of universities and research institutions that would promote the use of that bandwidth. And they would encourage their universities, so Indiana University is an Internet2 member. So it's nothing more than a club. And they have to pay, but you have to pay a lot of money, like 30 thousand, I think its 50 thousand a year for a university to be part of the Internet2 consortium. But then you go to the conferences, and then you get to see all kinds of like engineering, science, all these, medicine, all these ways of people using this really high bandwidth. And then people more, and what the idea is, is just like the Internet. You raise a generation of kids and send them to college where they have access to this kind of dazzling new technology, and then they're going to move out into their houses, and they're going to demand it, and that's when the companies plan on reaping the profit. It's all, you know, it's like a 40-year plan. And that Internet2, you know, was the organization established, non-profit organization. The headquarters are at the University of Michigan in Ann Arbor. So that's what Internet2 is. But every country has their own consortium. So suddenly the same bandwidth in when you get to Canada is called Canary Net. In Europe there's several names for it. Right. So it's not Internet2 all over, it's really just a consortium. So that's what Internet2 is.

MC: Okay, great. Is Internet2 currently a necessity for performing telematic music?

SD: No. It's not. And this is another thing that I've stood on soapboxes for a long time. The problem with Internet2 productions is that they're exclusive in nature. You have to be, you know, there's basically about 200 universities that are Internet2. Add another 50 things like certain museums, like the Walker's Internet2. I mean, certain big museums have signed on, too. Then they get that bandwidth, right? Because that's the thing, if you're a member, then you can get access to the bandwidth. Because they make the financial arrangements. But I've argued for a long time that telematic music has got to be, you know, successful telematic art, or what the vision is, it's going to empower the population of the world. You know, the everyday person. Who has, the guy who lives in an apartment in Toronto, you know, and is paying rent, but he

doesn't have a theater, he doesn't have a studio space, you know, and he certainly doesn't have 30 thousand dollars a year to invest in Internet2.

And I've always argued, you could go back, I could go back and show you example after example, after example, including the opera, where we included people that did not, weren't on Internet2. Because I've always felt like, and that's why I also feel the same about these software applications being low price but smart. I've made the argument if we keep it just to this group of people that you know are self-congratulating, "oh we're all Internet2 and look what we can do now," you know, that 99.999% of the population has no understanding of that, they have no access, they don't, it's very exclusive in nature, and therefore counterproductive, and therefore not good for our academic stuff. But if we're serious about working in the service of our citizenry, we need to cultivate things that they can use.

MC: Right.

SD: And so, I've done telematic, I remember one where one of our main players, it was that play I was telling you about, David Henry Wang, who's obviously Asian, he said, "You can write any music for this you want." Someone did original for the music in New York, but then, in the instructions, he says, it can be, [inaudible]. We did, we made our own music for it. But we, he said he'd like Asian elements, and so we had this shakuhachi player, one of the best in the country, but he's a chef in San Francisco, and so basically he got on dial up, and we were having him do a little tiny thing through dial up that we plugged into the sound system. And he was just playing into, like, a little, you know his little computer microphone. But we did it.

And so I've always pushed for, ok, what are the low budget options. You know, what are the ways that people can do it using just regular Internet? Now it's not as good, but it's empowering a lot more. So what do you do? Do you do something that's great, where just a few people? Or do you do something that's not as great, but like millions of people can try it themselves? And that's the options I always go for. And this is becoming grass roots. You know there are several events now that use telematic stuff. Chicago Calling in Chicago. They have nothing, I mean they access some universities, but not originated from universities at all. That New York Electronic Music festival; they do some telematic things. Some clubs, like certain clubs are doing it. And another really big area, it's outside of academia now, of course they're paying for it: churches.

MC: Oh really?

SD: Big time. Huge. With the big fundamentalists and the big like Pentecostal. Like the churches that are really, have the mega churches. Because then, they'll have five thousand people in their auditorium, like, "Let's hear from Pastor Jones down in Bryan, Texas," and suddenly he's on the screen, you know, "Hey pastor, well, here's our choir!" And they're singing. You know, they have elaborate production facilities now for that. And they buy the same media like the sports and the television, and that kind of access, you know. In fact, there's a guy in Bloomington. I went down and gave a presentation in Bloomington on my work, and for the Indiana University Arts and Humanities Institute. They've invited me down and there was a guy in the audience, and we talked afterwards. And he's doing a PhD, and he's doing an ethnomusicology degree. And his area he's studying is these churches using the Internet to connect to each other.

MC: Interesting.

SD: Yeah. And he said they're very sophisticated. They're very sophisticated. We, our, at IUPUI we get students every year who want to do that stuff.

MC: Oh, really?

SD: Or they're attached to a church. I mean, church, music technology and church music ministry is part of our thing at IUPUI. I mean we don't have a track for it.

SD: But we always have people who are coming there because they're doing that, and they're coming to IUPUI to get technology chops. Always. And some of them have been in the Collective. You know, they'll end up in the collective, and then either they bring me ideas, "Here's what we're doing." Like there was one guy, he knew all about, he could connect anything to Ethernet. You know, "You don't need fire wire, let's do Ethernet." Why? Because he was doing all this stuff with Ethernet all the time. And so he could do multi. They even have ideas for multichannel audio and stuff that's not, they don't know what JackTrip is; they have their own thing now.

MC: Do you have a recommendation for speeds of downloading and uploading if you're going to do something?

SD: Yeah, I do. I think that you want to shoot for a 100 megabit connection. You can pretty much pull off anything you need to pull off with a 100 megabit connection. That's what we had in technology day. We didn't have 10 gigabits, we had a 100 megabits connection. Next year we might, if we do it again, if we decide to do tech, decide to do telematic stuff, I could probably arrange for that, but there wasn't enough time, and I didn't have the money. But 100 megabits will put you in business for sure. There is a business bandwidth rate for most North American cities now, and the standard download speed for that, I actually have it in the house here, is around 40 megabytes per second. Because as you know, the normal home consumer rate is somewhere between 5 and 15. And 15 is like the premium, right? Where here, but big cities now, the premium you pay a lot more for, but it's up to 40. I say that loosely. Up to 40 means most of the time it never gets to 40; it's more like 30.

MC: And what about upload speed?

SD: Upload speed needs to be minimum, minimum 20. And see the upload thing is usually where you get screwed, usually, your typical home thing, it's…

MC: It's 1. That's why, of course, when we did our thing with Kyle, you know, did it at the university. I speed tested at the University, and it was 37. You know, at the university it seems like I can get somewhere around 30 or, or higher. But it's, there's no way I can get that at home where I live.

SD: Yeah, you need, but you need, yeah, minimum, minimum, minimum, bare minimum 20. Bare minimum.

So like when we did the Phillips Collection, you know, that was a big problem because they didn't, they were supposed to, they did. This is the interesting thing. Oh, this is a good anecdote for that.

Phillips Collection is a very important museum in the United States. And it's heavily endowed. Have you ever been there?

MC: No.

SD: It's really cool. Big business, though. So they wanted to put on the opera, and we explained, you're going to have to, they didn't have the bandwidth. And so they sought it out, and they established an agreement with their provider that they would have enough bandwidth, and the download speed would be over 50, and they would give us assurances. And then we started doing testing to find out, they still had a 2 megabit upload speed.

MC: Wow.

SD: And it was a complete disaster of negotiating. We finally got more, but we just said, "We can't do it," you know. But that's when I discovered a lot of these companies, they screw you over. They give you the download, but what the gold standard is, they don't give you the upload. And so, we finally got some; it was never adequate, but we got more upload. But that's, that's the linchpin for sure.

MC: Are there other options besides the Internet for performing telematic music, at this point?

SD: Well if you think of telematic music, if you take the first two syllables, *tele*, you know, it's telecommunications. So yeah, I would, you know, if you had to, and I think we even did this once, someone played into their cell phone because we couldn't get the connection.

MC: Okay.

SD: But is that a satisfactory one? No. Until the time comes where you know with the big boys, like, you know, NBC, the big networks, you know, if that takes so much power and so much hardware that's the thing, the big networks, they have billions of dollars worth of gear, expensive gear, and they have satellite hook ups, like they have the whole thing, you know. That's an alternative, but it's not, it's not…

MC: It's not feasible.

SD:…an alternative for the artist in his home, or even the artist in the university, it's not an alternative.

MC: So certainly you'd say the best, I mean, the only real, usable scenario at this moment is the Internet.

SD: [nods]

MC: Okay. And how does telematic performance change the audience's relationship to the event and to the performers?

SD: Great question. It's an intangible, but it's there. I've seen it, I've watched it happen, I've felt it. You're doing something in the moment, you're doing it live, a person's on the screen, I grew up, you to a lesser extent, but people in my generation, I grew up, the screen was always something one-way, it was always a one-way street, it's coming to you. Your only control over it: either turn it off, or change the channel. That's all you can do. In fact, the very very earliest, some of the very earliest media art like where it was like on a screen, it was art, involved the rebelling of that. It's like Nam Paik? Remember that guy, he was very famous, he was an associate of John Cage's, he was Vietnamese or something [inaudible]. You know one of his pieces, it was something I wrote about once, or I read about it. But it involved, it was this television, and it was in a gallery somewhere, and it's on, but there's this gigantic magnet sitting on top of the TV, like this huge magnet, right? So what is it doing, it's completely fucking up the image.

But the point is that the person has control over the media, like they can do something to affect the media, but even that, it still wasn't sending it. So, what was your question again?

MC: How does the telematic performance change the audience's relationship to the event or performers?

SD: Right. Okay. So suddenly with telematic art, the screen is two-way. You're sending, you're receiving, and then you're engaging each other. And there's something, there's this palpable, whoa, this is like a really amazing thing. This is live, but we're on different parts of the planet, and it's this exciting thing. And then also like in the opera when we did the NOMAD system and people could talk, people talked about that. That was always people's favorite part of the opera. Whenever people talk about the opera, they say, "I loved the fact that I could do that" or "I loved that I could watch and someone from Norway was saying something" or someone from Alaska, and I could relate to that. So you know, there's this palpable connection people get when they realize that they're in this artistic thing, but that they're being brought together to other people in different cultures and different countries, and that the sense that we're all together anyway. The distance, the distance factor has been eliminated.

MC: And do you think the audience reacts differently to seeing people on stage and on a screen? Like do they have a different reaction to the portion on the screen…

SD: Yes, entirely.

MC: …because it's on the screen?

SD: Absolutely. Absolutely. And that's why I argue, I'm really against streaming stuff, not against, but I just don't think it's very effective.

SD: When's the last time you sat down and watched a streaming concert?

MC: It's been several months. Yeah.

SD: How many have you watched in your life?

MC: Like half a dozen.

SD: Okay.

MC: And I only do it because it's the only way to see some of the things I've got friends doing.

SD: Right.

MC: That's it.

SD: But you would never sit down, "Oh Friday night. I'm going to watch a streaming concert."

MC: Right, right.

SD: "It's going to be fun; I'll pop some popcorn, and have a glass of wine. I'm just going to put on a view screen, and I'm going to get into it." Why? Well, it's just one camera, staring there. It's way too far back. You don't get, I mean, you could be in the hall with the same view, but you're in the hall with all those people, you're bodies next to you, right? But when you're just sitting in your home, it's not very satisfying. And so also, if you go to a place, and you know, like for instance Peter's performance. Now, we did, you know the video was from us.

MC: Oh ok.

SD: Did you know that?

MC: I don't think I did.

SD: I know, people didn't. I should, I should have made a bigger deal about it. They created the video over there, but I told them, well I argued with Peter. I didn't argue, I said, "Peter, it's not really telematic. It's not telematic unless we're doing something at both ends."

MC: Right.

SD: And so we're trying, and I said, "Is there going to be video with this?" He said, "There could be. I've worked with a videographer." I said, "Why don't you have him make some video and then send it to us, and we'll do the video and mixing here, and so then it's, you know, it qualifies." And so it was great. That said, it was still, it was just Peter on the screen with some

art. And everybody's sitting there, and it was like now, we're going to watch a movie. And so I don't think that's satisfying. Or I don't think it's what it can be. But when you stick people on the stage, and then you see the people on screen, and you see that they're engaging, that pulls people into the interest level. In my experience.

MC: So it's really important, you think, that we have both people in the flesh, like you've been saying, and people on the screen to kind of create that interaction.

SD: I think telematic art is a very social event. That's one of the most important parts of it. And so it's not a thing to make it easier to watch a piece of art.

You know, that's a crappy thing, and there's a lot better ways to do that. Just make a DVD and send it to people, or just make a movie and post it. You don't need to do it live, it's too much trouble. And the results aren't good. It's much more work; results not as good. If you want to just pull something for people to watch on their screen, produce, spend that effort and money you would have done there, make a nice, get a better camera, set up a room where you've got nice lights and nice recording, do a good job, and post it. Really.

So, but, it's a social, and it's also that's what I've noticed when people get turned on and get excited. It's not because there's a brilliant piece of music or there's an incredibly good looking person, you know, taking their shirt off, guy or woman, it's because there's this communication between live people between flesh and blood, both media, and you're in the room with them. And you know while you're in the room with them, that these other locations, there's people in the room with those people, and so suddenly it becomes like this very big, intimate meeting. And that's the magic, in my humble opinion.

MC: So in my research into this, one of the kind of big components is a certain amount of audience interactivity. And you can see that when kind of the American avant-garde with like Fluxus. Do you kind of see that as being a predecessor to this?

SD: Very much so. Yeah, I'll give you my Intermedia, did you come to Intermedia festival?

MC: No.

SD: Because I wrote an essay, and I, for that movement, and I talk about them being the roots of much of our work. I mean like basically giving them full credit. Because we named it, actually Intermedia comes from Fluxus too. You know that, and so we named it, the festival, as like an homage to them. So, yes, it's very much from that aesthetic. Very much.

MC: So when you started performing telematic music, was there any actual music written for the medium, or did you, were you commissioning music, or were you taking other pieces…?

SD: Most, since I've been doing this, most of it has always been improvisational music, and as a classical musician, I've always had a problem with that. And so, there would be like music quickly written, like you know, when we did that thing with James Olivero. He wrote a piece. But he wrote it was kind of like, commercial, you know. I've started writing music for the

medium. But no, there's very little music written for the medium. So people have tried to, and I've fought it tooth and nail, have tried, "Well, let's do this John Cage piece." Well, you guys did, right? That one worked.

MC: I think so, yeah.

SD: But often it doesn't. Like "What kind of Stockhausen piece?" No, no, no, no Stockhausen.

MC: I know when we picked the Cage, we were conscious of aesthetic elements of Cage's music that kind of lend itself toward not being completely ridiculous.

SD: You can, you can get away with it with Cage.

MC: Right, right. We were cheating, but it worked.

SD: And he set up the scenario. He made the ground rules loose enough.

MC: Right.

SD: He set up the rules. And so, if you follow his rules, you're safe. You're not safe from the Cage purists,…

MC: Of course

SD: …as I've come to find out, but you're safe from his rules.

MC: Right.

SD: But most composers don't set up those rules.

MC: Yeah.

SD: Another one, another piece I think would be really fantastic, there are some pieces that work well for the Internet. A percussion piece, since you're a percussionist, "Liaisons" by Roman Haubenstock-Ramati would be a great Internet performance, I think, in my opinion. Because you can do recording, you've got two people, you can do all kinds of things, and you're safely within the rules of the piece. So there are pieces like that. But if you don't find that, the other thing to do is either improvise or to write something new.

MC: So have you seen much growth in the composition of music for the genre?

SD: No. Oh, but then you'd want to go to the ICMC backlog of conferences because they've had a whole day. They've had, this last one they didn't, but ICMC over the past 10 years has had some of their conferences, they'll have a whole daylong track of telematic music.

MC: How do composers deal with the problems that currently exist within telematic music? Some of the latency issues, things like that?

SD: Well, how about we rephrase the question: What are some of the issues that a composer should deal with?

MC: Okay.

SD: Because I don't, I can't speak to how composers do it, but as, what you should, as someone who's composed for it, I can address that. Definitely have to deal with the latency, and so, are we going to talk about Goldstream? Is that a couple of questions about Goldstream? Or should we go to that now?

MC: We can talk about it now.

SD: Okay. So for instance Goldstream Variations, you know that piece was written very much with the telematic medium in mind. So there are a lot of big fermatas, and with like, there's a really fast passage, and then there's a fermata. Why? Well this is the place where the electronic artists can then capture that stuff and then do things. Also gives time for other people to catch on or catch up. Another way to deal with the latency is to not try too hard to make rhythmic things highly complex and highly synchronized where there has to be high precision rhythmically. My argument is, some people's argument is like, "Well we, this isn't very good music because you can't like play sixteenth notes together at quarter note equals 160." And then my argument is, who said we have to do that? I mean we're talking about a whole spectrum of music. Really? We're going to get caught up because there's a couple things it can't do? My friend, let me tell you all the things you can't do in a concert hall that you can do on the Internet. Does that invalidate concert hall music? You know?

MC: That's a great point.

SD: It's like any time you deal with a music performance you have limitations. And you also have to take certain things off the table. Right? If you have a trio, that doesn't mean it's for 300 voices. It's for 3 people! So anyway, my strategy is if you want a highly complex, highly precise, rhythmic passages between multiple people, put those people on the same stage, and then have someone else do something out here, you know? It's like if you want that element in there, then put that element in there, but create a scenario for it. So, you know, and this is where Matthew and I came up with, and Matthew gets a lot of the credit, too, you know. But we were both thinking the same thing, but then he was composing, I mean, the opera is, I think, a major accomplishment, because it's one of the first, in my opinion, if someone wants to disagree with me, fine, but it's one of the first pieces where it's actually a piece of music, here's the score. You can play that damn thing, you can play the music, and it's designed for telematic art. With an audience. So it has a timeline. And so the way it works is that he achieved it by having these washes of ensembles overlapping,

And so you were hearing multiple stuff and it's self-interesting. I'm saying the idea of overlapping, of not trying to highly synchronize, because there's plenty of other things you can highly synchronize. So I'd say that's the biggest thing.

And then another compositional thing is how you deal with, if you want to go in the telematic realm, I think you need to, you can't, it can't just be playing the notes. There has to be, telematic art implies there is social interaction. It implies there's some kind of idea of connecting. Otherwise, why are you doing it? Just do it for a regular thing. And so I think that those, that has to be foremost in the mind as one composes a work for telelmatics. Is some kind of interactivity. As opposed to, like if you just do a string quartet, you're only thinking you're going to have four people, and they deliver to a passive audience. That's the only model that we have. And that's the one model that doesn't work that great on the Internet. It's like meaningless. You have four people playing on a screen, and the audience is back, that's not fun. But we could do thousands of other things. But, so, that's the thing that I think if it's going to be a composition it needs to have an interactive element.

MC: Great.

SD: But can I follow that up with Goldstream Variations?

MC: Please.

SD: Actually what I should do then, is I'll send you Goldstream Variations.

MC: Okay.

SD: And I have two pages of instructions.

And the point of Goldstream variations is that what you exchange, I mean, to me it takes really skilled chamber musicians to play it, at the highest level. It's open instrumentation designed for telematics. Why is it open instrumentation? Because all these telematic groups, the instrumentation is always different. And you're limited, you're dealing with the people that want to be there. So this telematic, you know, intellectual group over here, they've got a double bassist and a saxophonist and a percussionist that they can round up. This group over here has a string player and a trumpet player. This group over here has a keyboard player. And so if you write something, nope, sorry, it's got to be a string quartet and a guitar and a clarinet, then you're never going to get it played.

But in this work, it's like more often, what drives the performance is that people want to do something, and so you've got to write something that you can hand to them, and say that, yeah, you can make this work for your scenario. Which is exactly how I did it, pitched it with Michael, which is why he bought into it. Because he was like, "I don't know what to do. Are you talking about improvisation, which I think is a joke?" I said, "No how about this, I've got a piece, I'll send it to you." Then he didn't have to worry about it. He just handed the music to his people that he could get. It was open instrumentation, and then, you know, with a pitch set. That

everybody could play it. I designed it that way, and I made it loose enough where you could fit within those parameters. So it would, you know.

And then the other thing, so what's the skill? The skill in it isn't so much that you're going to do this really difficult thing together. But the skill is that you have these passages you've got to learn to play soloistically, And they're very virtuosic, you know, fast, and very virtuosic, but you have to play them, and this is where the skill of a classical chamber musician comes in. You have to play them in the context of the other players in the room and also coming through the loud speakers. And so you have to place it. And you have to calibrate. And you have to be listening. So suddenly there's all these elements coming in and the difference between a great performance of that piece and a lousy performance are the players' the ability to effectively space their music. Does that make sense?

MC: Yes.

SD: And, not make it too dense where everybody's playing all the time, or not make it too empty, but to learn, and then also to play like someone's doing something, if they're going off in a certain energy level. How do you want to react? Do you want to be that same energy level, or do you want to be less? You have those choices. To me, it takes a lot of rehearsal, and it takes a lot of skill, but that to me is a telematic element.

MC: Absolutely. That covers pretty much all those questions. How many composers currently write music intended for telematic performance?

SD: Very few.

MC: Very few. Ten? Less than ten? More than 20?

SD: Less than 200 in the world.

MC: Okay. Alright. Let's move on to Auksulaq.

MC: Alright, can you just kind of state what your role was in Auksulak.

SD: Right, right. A good, did you read that chapter, it's, there's a chapter on my website…

MC: Yes.

SD: …in that book that gives a lot of background, you can just quote freely from it, so. I was co-creator of it.

MC: Alright. What were the technical requirements for the piece?

SD: Very good, it's, well you had to have, for the most part, you had to have access to broadband. Technical requirements…kind of everything we talked about. I don't know that we

tried to write it. I always pushed hard to have it, in the end, to have a hard drive of media and a score. And a book of instructions.

MC: Okay.

SD: Because the technology is changing so fast. You know, my intent was that it would last a long time. You want to build something that to last. And so if someone has the score, and if they have the instructions, and if they have the media, then as things get better, they could still do this. And then as things get easier and more effective ways to do things that they could employ the more effective ways to do things, they'd still have the original media, the interviews, the imagery, the photo sets, the movie sets. That they could video mix. That's the idea. The idea isn't to have something that you just turn on and it runs.

The idea is to have a collection of things that you have video artists who take that material at each performance and then come up with something really wonderful, and they arrange, and they work with the musicians. Now we get another philosophy, philosophical point. We were raised in our music environment or music education where, Beethoven's symphony: here's the score, here's how you play it, here's how New York and Boston play it, this is what you must do it, or else you're a loser.

Where I think in telematic art, and also electroacoustic music now, here's and, I certainly include Big Robot and my compositions, here's a detailed score, here's detailed instructions, here's media, a new element, some of the sound files, you know, the raw materials. Go for it. Please don't do it the way we did it! That's not the point! Do your version of it. We'll recognize it! Don't try to do it exactly the same. Why? We already did it that way! Which runs counter to this whole thing, you know, it's like now we don't really fit into this world anymore of, like, "Nope, that's not the way it's done." Well who said, "That's not the way it's done?" That's my question. You know, and the jazz world, of course, has lived on this thing. And pop music. Frankly, every other category of music, except for classical music.

You know, someone hears a great song: "Okay, here's my version of that." Great. Sometimes those second and third versions are way better than the first ones.

MC: Why was this piece done telematically?

SD: Auksulaq?

MC: Yes.

SD: Yeah. Okay. That's a really good question. I'll go through this really fast. I was deep into the whole telematic thing in Alaska. Well into it. There were many of my colleagues at the University of Alaska, including my wife, were heavily involved. Their work directly relates to climate change research, understanding it. And the north is much more affected than the rest of the world. The two poles, right, really changing dramatically.

So there was this colloquium that came about and was organized, and I was invited to be part of it. A body of scholars: scientists, artists, political scientists, many, many disciplines. And we'd have meetings, we'd talk, and so through those discussions, a couple of scientists said, "You know, you ought to do a musical thing about all this." Because actually scientists, much more than musicians, scientists see musicians do what they do, but in a creative sense. And they have a lot of respect. That's why we have a lot of scientists who send their kids to take music lessons, and they're music lovers. And a lot of them are musicians, too. A lot of scientists are musicians. In band, and in college, too, right? A lot. So, they were like, "You ought to do something." I was involved in telematic, I thought, but the thing that made me put two and two together when they suggested that was a need for a discussion on a broad level of this issue. A need to be able to get the information that scientists are coming up with, like the IPCC, the international United Nations Intergovernmental Panel on Climate Change, right? Comes out every 5 years, a report, a big report. A need to disseminate that and generate discussion. So I thought what better way than a big, large-scale telematic thing, where you could have audiences in other parts of the planet, they're watching together, they're seeing the devastating things these scientists, and some of these scientists, they basically say, it's like being in a doctor's office and told you have cancer. They don't say, "You're dying in six months." What they say is, "Well, here's the report. And what it shows here is that, that in a population of 1000 people we diagnosed with this kind of cancer. The survival rate is at, the median is 2.3 years and extending to 5 years." And then they don't say anything else, and then, you mean, "So does that mean that my dad's going to die somewhere between 2-5 years?" And they said, "Well, this is what that report is saying, that the median is…" and they'll just repeat. They're never going to say, "You're going to die." Right?

MC: Right.

SD: And so that's the way these scientists talk, and it's devastating if you're listening to them. So, how do we do that? Movies, let them talk. Live scientists, let them talk. Music, well they're like the Greek choir, right? And then you have these, and it's all over the world.

And so the vision was that, well, if it's a cool enough piece of music, and it takes off and everything, you could with the effort of a few people putting this together, you could generate a lot of discussion in places you're never going to fly to, you're never going to be able to visit, but then it gets there. So that was the motivation for doing the opera.

MC: So you definitely feel that having it being done telmatically is integral to the integrity?

SD: Oh yeah, oh yeah. And Matthew licked that problem, because then he was like, "Well, I'm a composer, and I don't want my piece, you know I don't want my music only being tied to this." And so he wrote every piece of music in the opera is like a chamber piece that you can also have played on the recital, like just without the telematic thing. It's just music, you know. And that's one way to attack it.

And actually Goldstream Variations, I've played Goldstream Variations without electronics and without the Internet. It works as a chamber piece. So you can do that, but you still need to provide for the telematic elements if you're going to be taking it in the telematic realm.

In other words, you can put something in the telematic realm, but if you're going to have it be telematic, it still has to have the telematic realm. Does that make sense?

MC: Yes. How did the technical elements function as a part of the piece? Specifically, were the changes in what screens were seen at certain specific points in time decided in advance or in the moment?

SD: We had a, and Matt, Matthew created it, but we, we talked about it, and he said, "Okay, I'll make the map." But we had a chart.

MC: I don't think I've seen it.

SD: So, for this particular performance, Matt's design was that as the audience was coming in, it already starts; he wanted to be really innovative. But this is minute zero, this is pre-zero, so even before this, the thing is starting, so there's video interviews, there's computer sounds, these are live scientists that we hired to talk. And then singers, singing their songs.

MC: Right.

SD: It was really long. This is also all the stuff we plugged into Backstage. And so we placed. And so, what is, it says, with the video interviews, start with spoken, okay, video, it says what, this is an early version. But then, you know, this would be video of like wind, cause the first section was wind, so we had wind videos, you know that showed wind in the arctic. And the snow blowing around and stuff like that. But then you had your choice. "Okay, well, now I've got 3 minutes, I need to do the wind videos, and I've been practicing, I know what the wind videos are, and I know what I want to do with them as the video artist, and so I've got those, now it's my turn to do those."

MC: So you have a general kind of blueprint, but you're able to be flexible.

SD: Loose and in the moment. So you can be artistic. Because you could have made a movie, you just go straight through, but we felt like that defeated the purpose. And it wouldn't be as good. And then it was going to be always the same. Again, we don't want the same. You know, so it was loose, and then here it switches, and we said, "Okay, here's where the interviews are going to take place." We had sections where the music would get really quiet. And then these, these talking heads would talk about things that are devastating to the earth. And then we'd go back into other, sometimes there was no talking, it was just like silent video while the music was going on. So that was all planned out. Over the whole, from beginning to end.

MC: So how did the telematic elements factor into the planning of the premiere?

SD: It took years. What we had to do was line up, and this is where the relationships, what Pauline said. You have to line up the venues and the people who are going to do it. And get them on board, get them invested. And so, it takes years.

MC: Well I remember I first heard about Auksulaq when I first joined the committee, and came in 2009, or whenever that was, to IUPUI for the thing, and that was still like, what, 3 years out from the actual…?

SD: Yep. World premiere in 2012.

MC: So how long have you been working on it overall?

SD: It was a 5-year project. With many, you know, like, ten no's for every one maybe. It's a numbers game. You'd talk to people, "Not interested," "Not interested," "Not interested." Someone was kind of interested, and then once in a while you'd get someone, "Oh this is amazing, of course! I know I want to do it." So like, Norway, Peter Cates. Peter gets really, he's one that his lights always go off when he sees, he gets it. You know. He always has. He's a percussionist. I find that people who are far away from the action really pick up on this a lot quicker than the people in the thick of the action.

MC: That doesn't surprise me, yeah.

SD: It connects them.

MC: Right.

SD: So Peter, New World Symphony, of course they weren't part of the premiere, but they did it, we did a version of it down there. Yeah, we did a 40-minute version down there at New World Symphony with Virginia and IUPUI. Obviously Virginia. Alaska, because I'd been there. Montreal, because they're really super into McGill, they're way into research, more into doing cutting-edge things, and Fabrice is on board for anything like that. So it's a matter of identifying people like that who have the interest, who have the resources, who have the musicians, who have the videography people, and there's a lot of elements. Philips Collection Museum, they decided, they really got excited. The Ear to the Earth Festival in New York is run by Joel Chadabe who is the president of the Electronic Music Foundation. He's also a very historical figure; he's a composer, he's a historical figure in the history of electronic music in the 20th century. And I visited him in 2008. I called him up, and I went. And he is an incredibly generous, benevolent, beautiful person. And we sat in his office, and I pitched the whole thing. And he had already heard Matthew's music, Matthew had done, Matthew's way into the eco music thing. And so he had put Matthew's music on a previous thing. And so he was like, "Yeah, I love this idea, and we will do it here. And we will get behind it." And so it takes that.

But then there were many other people, who were like, I couldn't even get in the front door. I couldn't even get a returned email, you know. And that's also part of this whole thing. I mean, part of being an artist.

MC: Yeah, so for the last few minutes, is there anything else that you think would be vital to be saying about any of this that we haven't touched on?

SD: I can't think of anything other than that I think it's a medium that's here to stay. It's new, it's in its infancy stages. I like to, when I've talked about it, I like to compare it to 1913. This is 1913, and the airplane was invented 10 years ago, and look what we're flying around right now. And everybody thinks that's the state of the art, but, well yeah, but if you go to 2013, we'd never guess it could do that!

You know, I mean think of a little bi-plane in 1913, like what the World War II airplanes were. And I really believe that about this stuff. Not just telematic art. Telematic art is a facet of computer interactivity and human interactivity. That's really the broader thing, you know, and how is that going to change things? That's why the name Big Robot. You know, it's not like we don't, it's not we're thinking this giant machine that does this. No, we're more thinking Google. There's artificial intelligence on the Internet now.

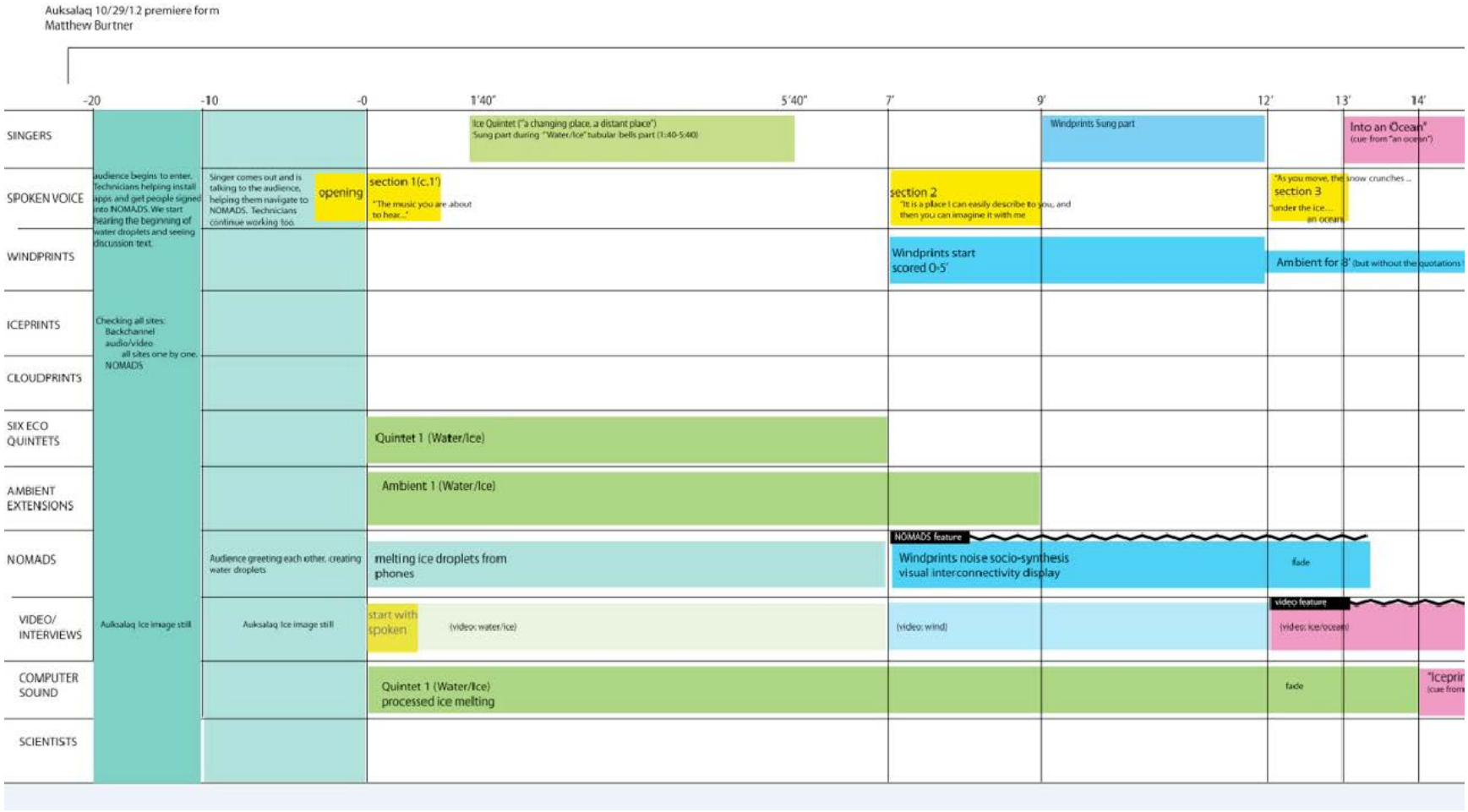
This is going to change us! We have no idea, you know, I just think, I always do that, I just think, what was life like a hundred years ago?

So that's what I'd say. It's a new infant thing; it has a really long way to go. It has dramatic problems. It's, most of the time it's not very good. I would say that, too. Most of the time, it's not very good. And I would include some of my stuff in there, too. I mean, I try to make it good, but most of the time, I think of it, as, I do think it's an experimental art form in the sense that it needs to be developed. Or if it's going to get good, it has, there are further developments required. But there's very exciting things in it, there's new opportunities, there's ways that we can use it in our evolving, you know, it's going to be part of how we evolve and communicate.

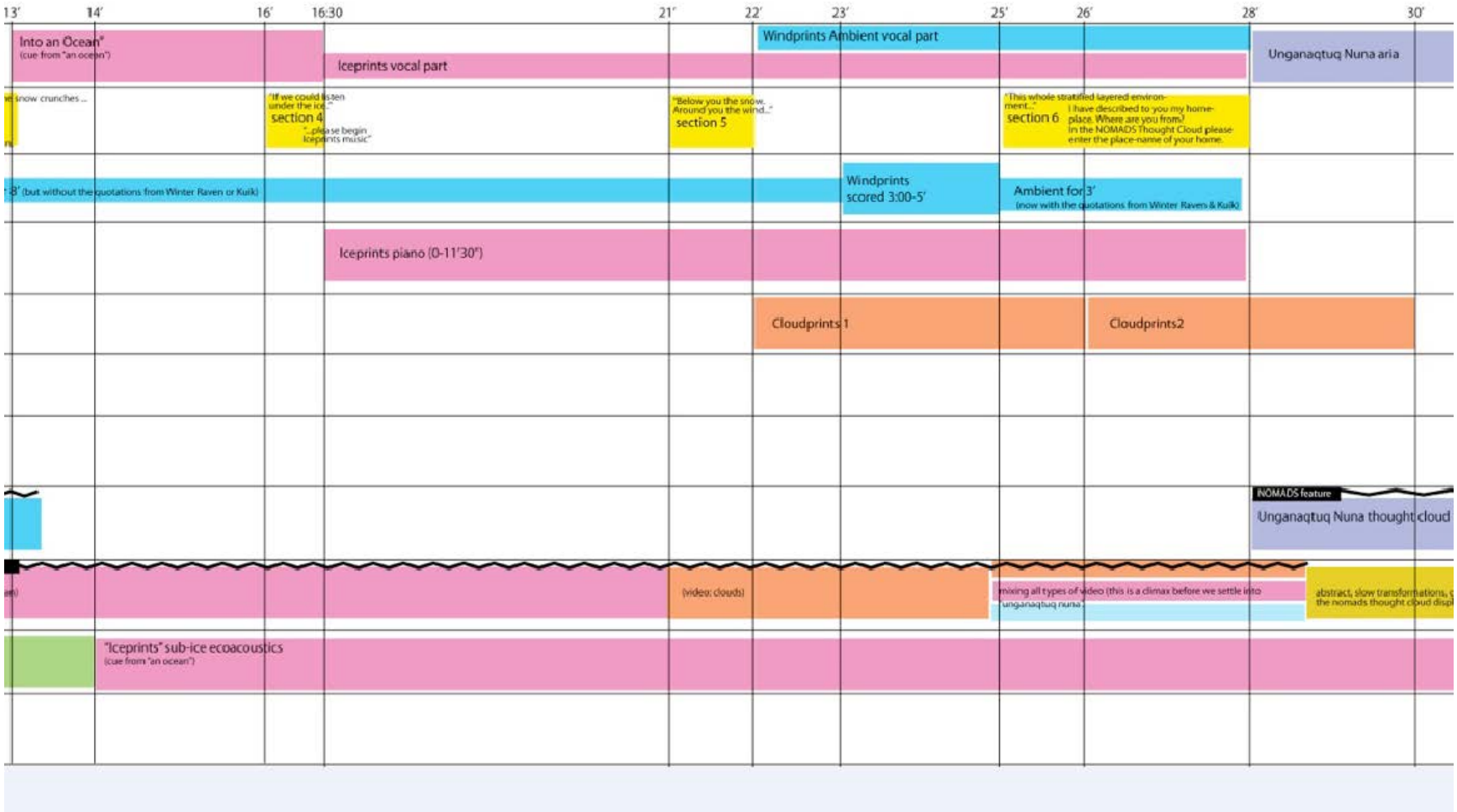
MC: Great.

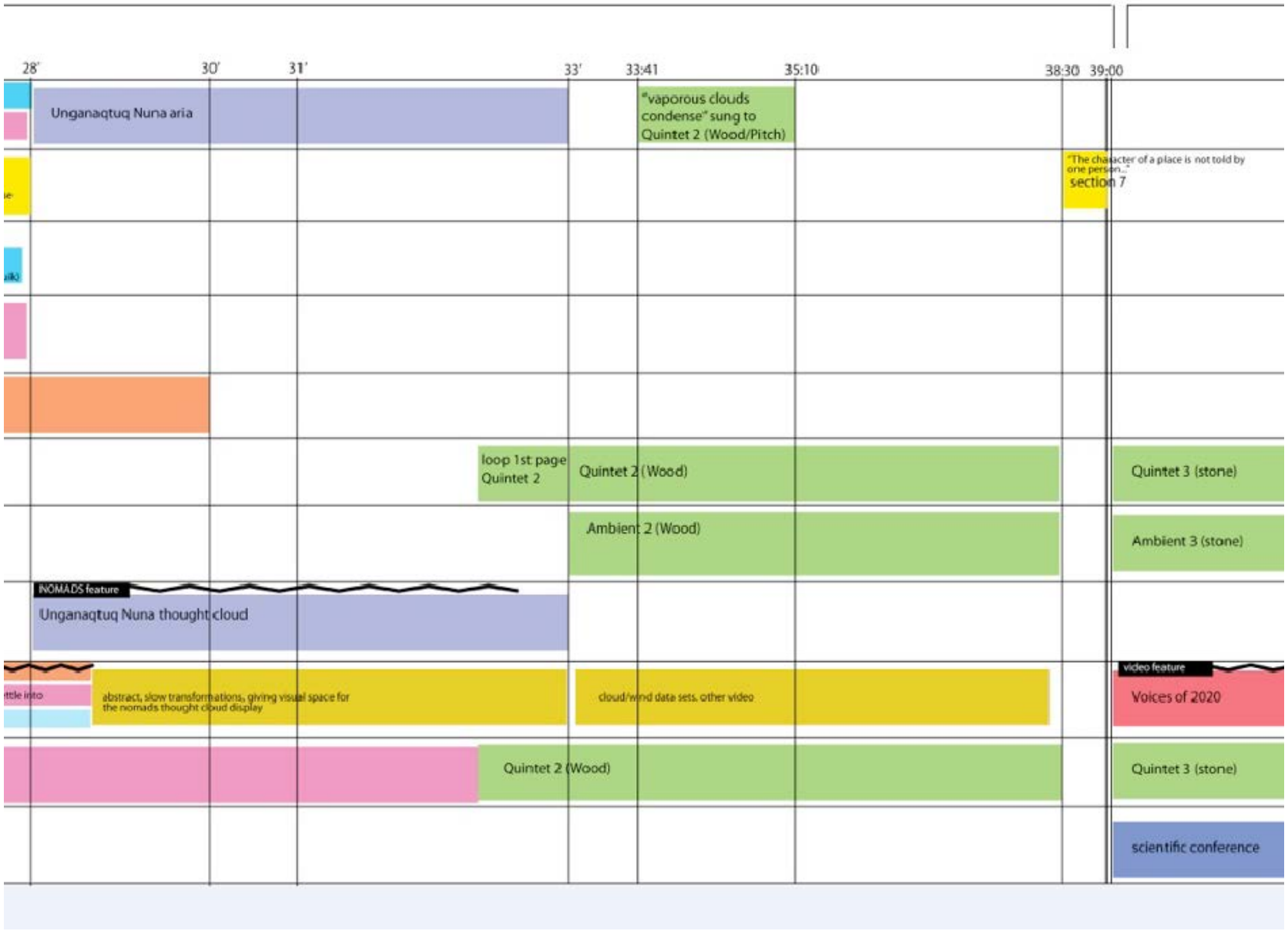
APPENDIX C: *AUKSALAQ* PREMIERE FORM

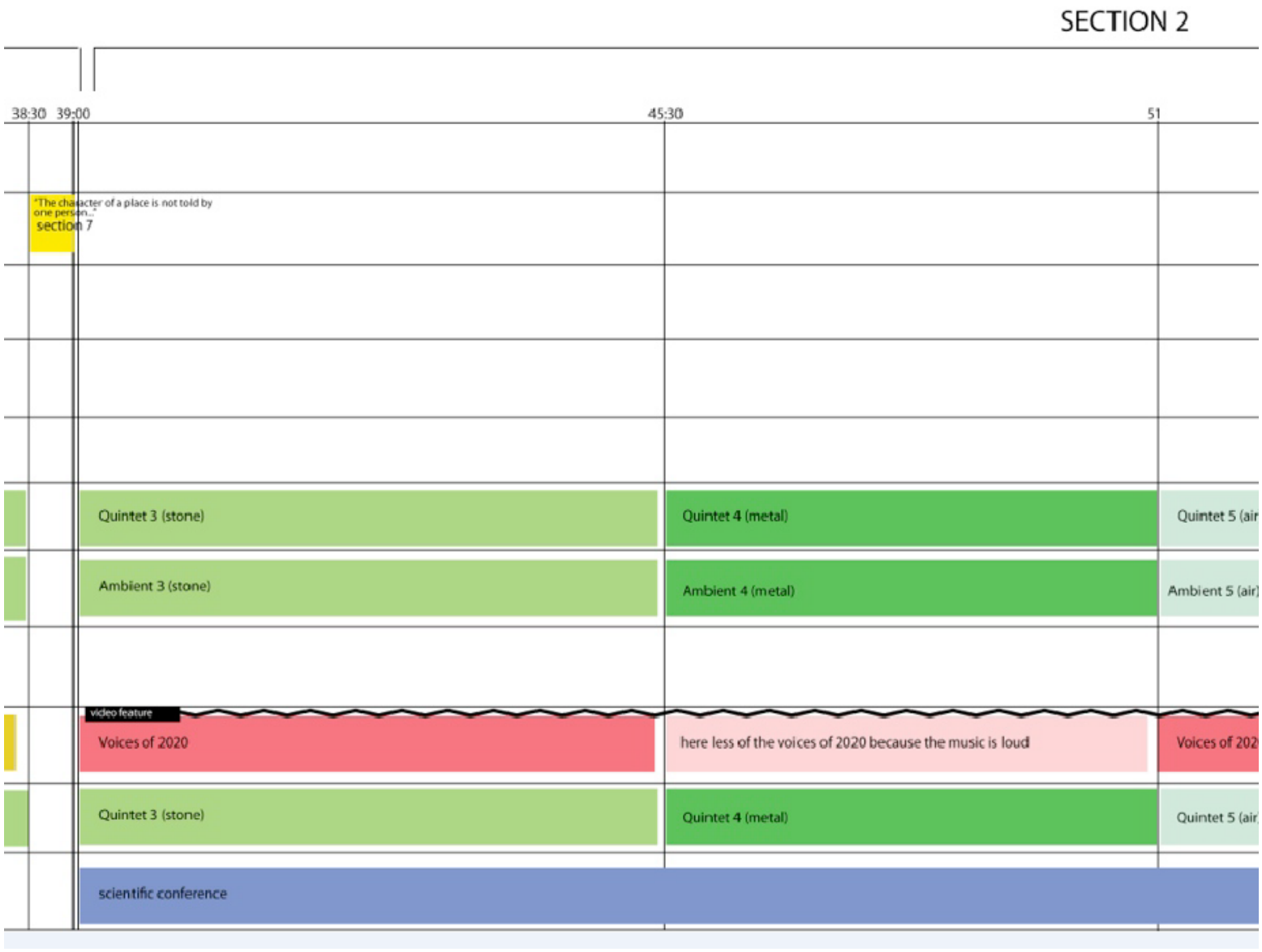
Created by Matthew Burtner



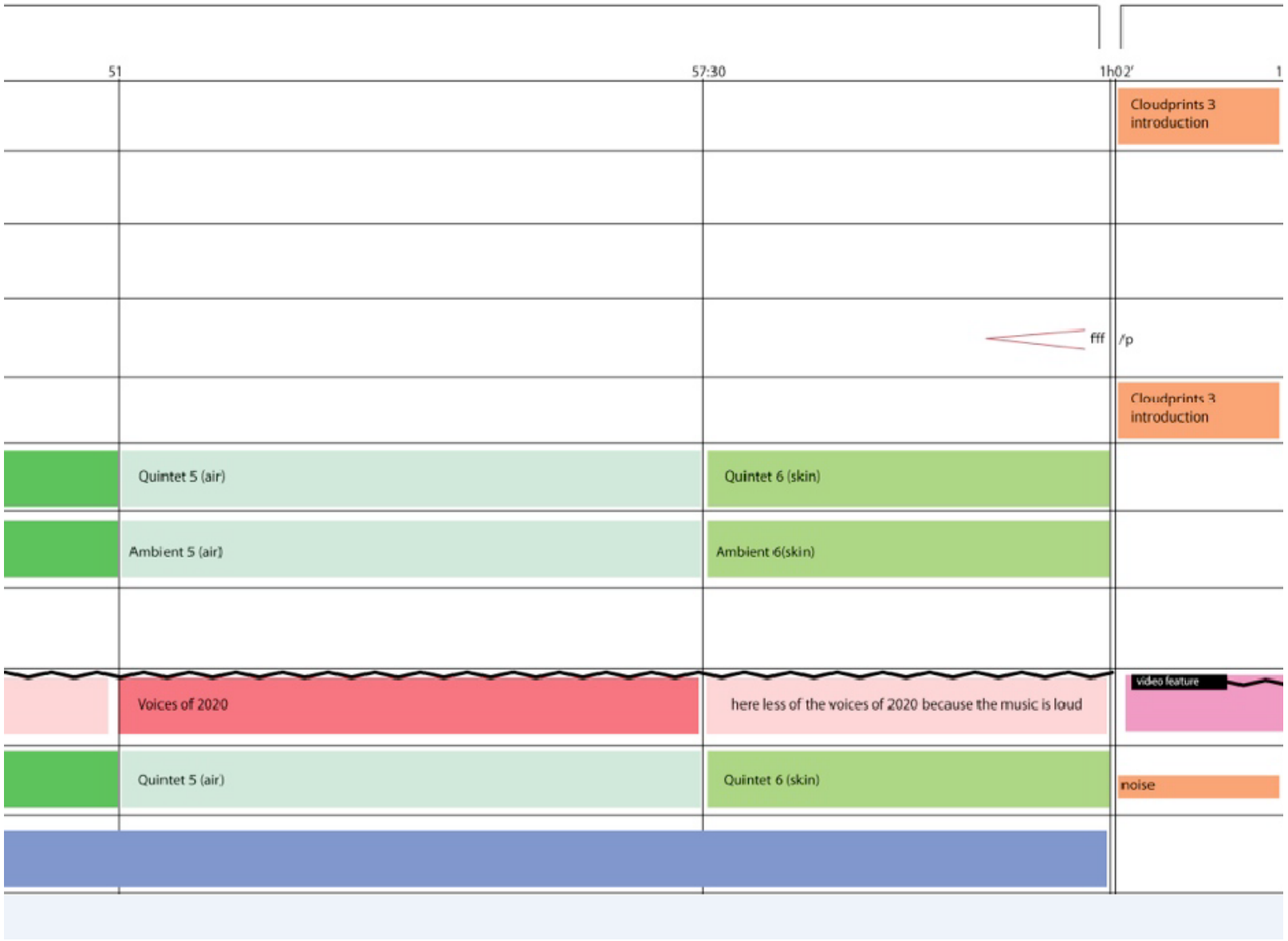
SECTION 1

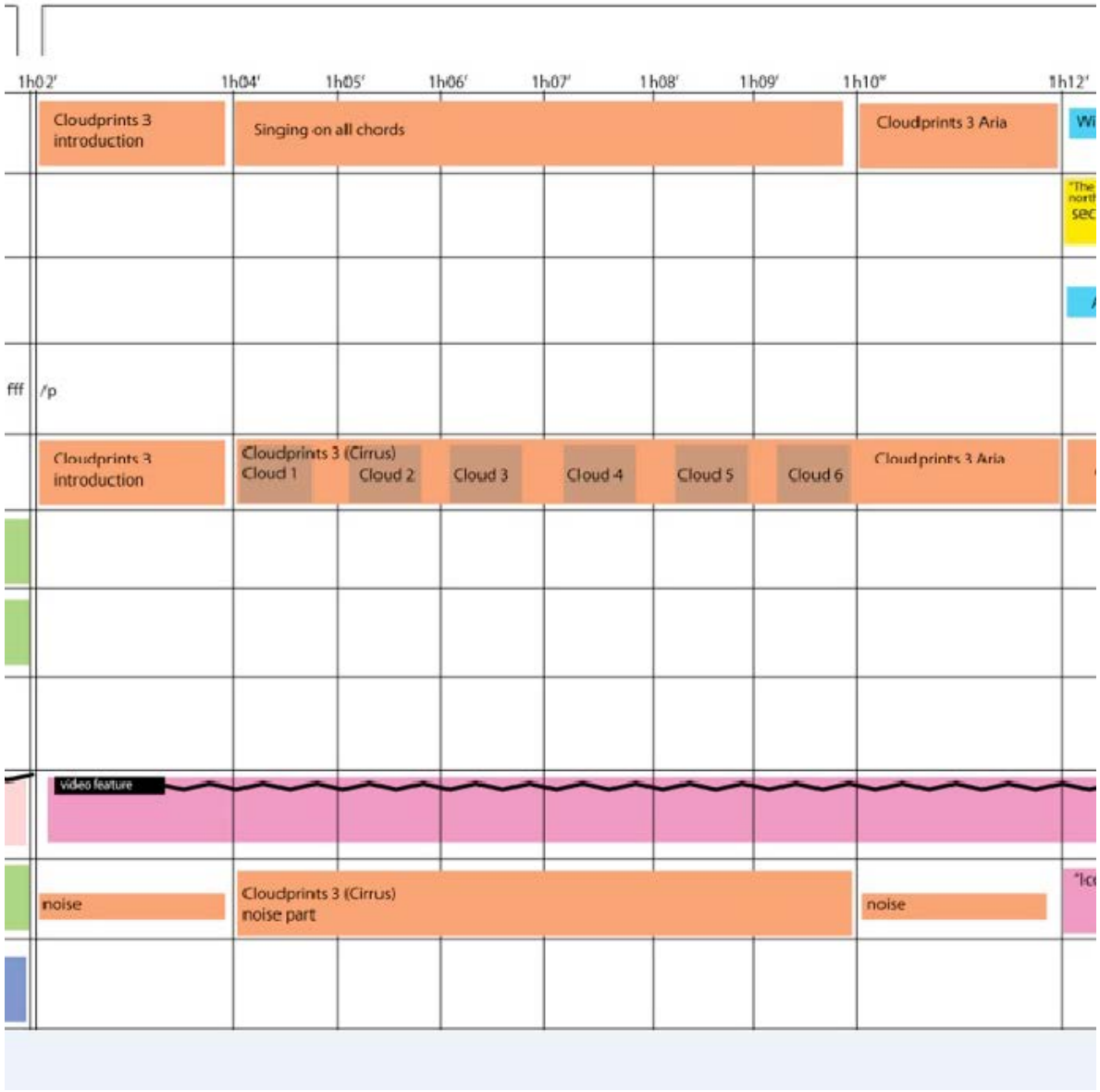

13'
14'
16'
16:30
21'
22'
23'
25'
26'
28'
30'
Into an Ocean"
(cue from "an ocean")
Iceprints vocal part
Windprints Ambient vocal part
Unganaqtuq Nuna aria
snow crunches ...
"If we could listen under the ice..."
section 4
"...please begin Iceprints music"
"Below you the snow. Around you the wind..."
section 5
"This whole stratified layered environment..."
section 6
I have described to you my home-place. Where are you from? In the NOMADS Thought Cloud please enter the place-name of your home.
3' (but without the quotations from Winter Raven or Kulik)
Windprints scored 3:00-5'
Ambient for 3'
(now with the quotations from Winter Ravens & Kulik)
Iceprints piano (0-11'30")
Cloudprints 1
Cloudprints2
NOMADS feature
Unganaqtuq Nuna thought cloud
(video: clouds)
mixing all types of video (this is a climax before we settle into
Unganaqtuq nuna)
abstract, slow transformations,
the nomads thought cloud displ
"Iceprints" sub-ice ecoacoustics
(cue from "an ocean")


28'
30'
31'
33'
33:41
35:10
38:30
39:00
Unganaqtuq Nuna aria
"vaporous clouds condense" sung to Quintet 2 (Wood/Pitch)
"The character of a place is not told by one person..."
section 7
loop 1st page Quintet 2
Quintet 2 (Wood)
Quintet 3 (stone)
Ambient 2 (Wood)
Ambient 3 (stone)
INOMADS feature
Unganaqtuq Nuna thought cloud
abstract, slow transformations, giving visual space for the nomads thought cloud display
cloud/wind data sets, other video
video feature
Voices of 2020
Quintet 2 (Wood)
Quintet 3 (stone)
scientific conference

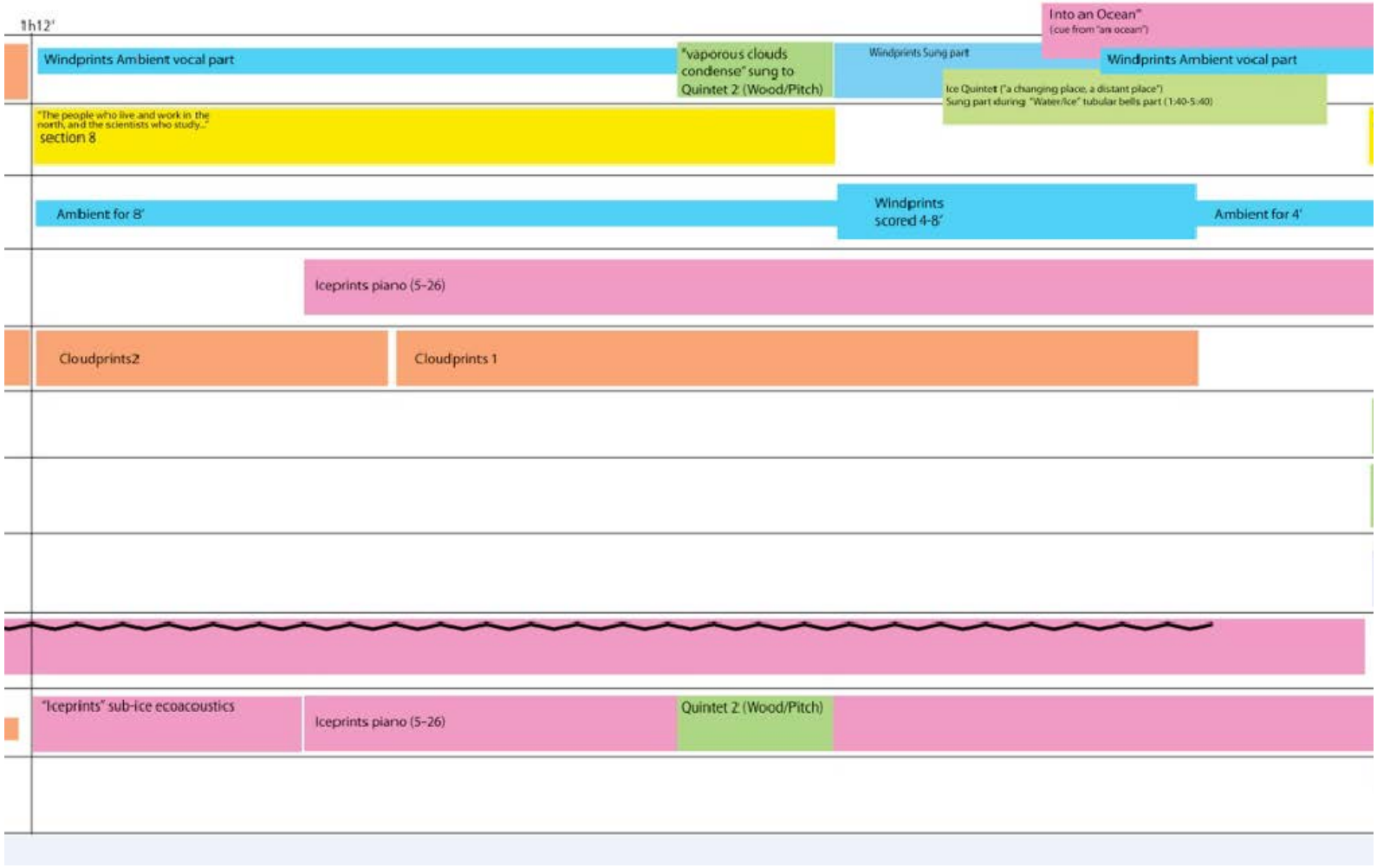

SECTION 2
38:30
39:00
45:30
51
"The character of a place is not told by one person..."
section 7
Quintet 3 (stone)
Quintet 4 (metal)
Quintet 5 (air
Ambient 3 (stone)
Ambient 4 (metal)
Ambient 5 (air)
video feature
Voices of 2020
here less of the voices of 2020 because the music is loud
Voices of 202
Quintet 3 (stone)
Quintet 4 (metal)
Quintet 5 (air
scientific conference

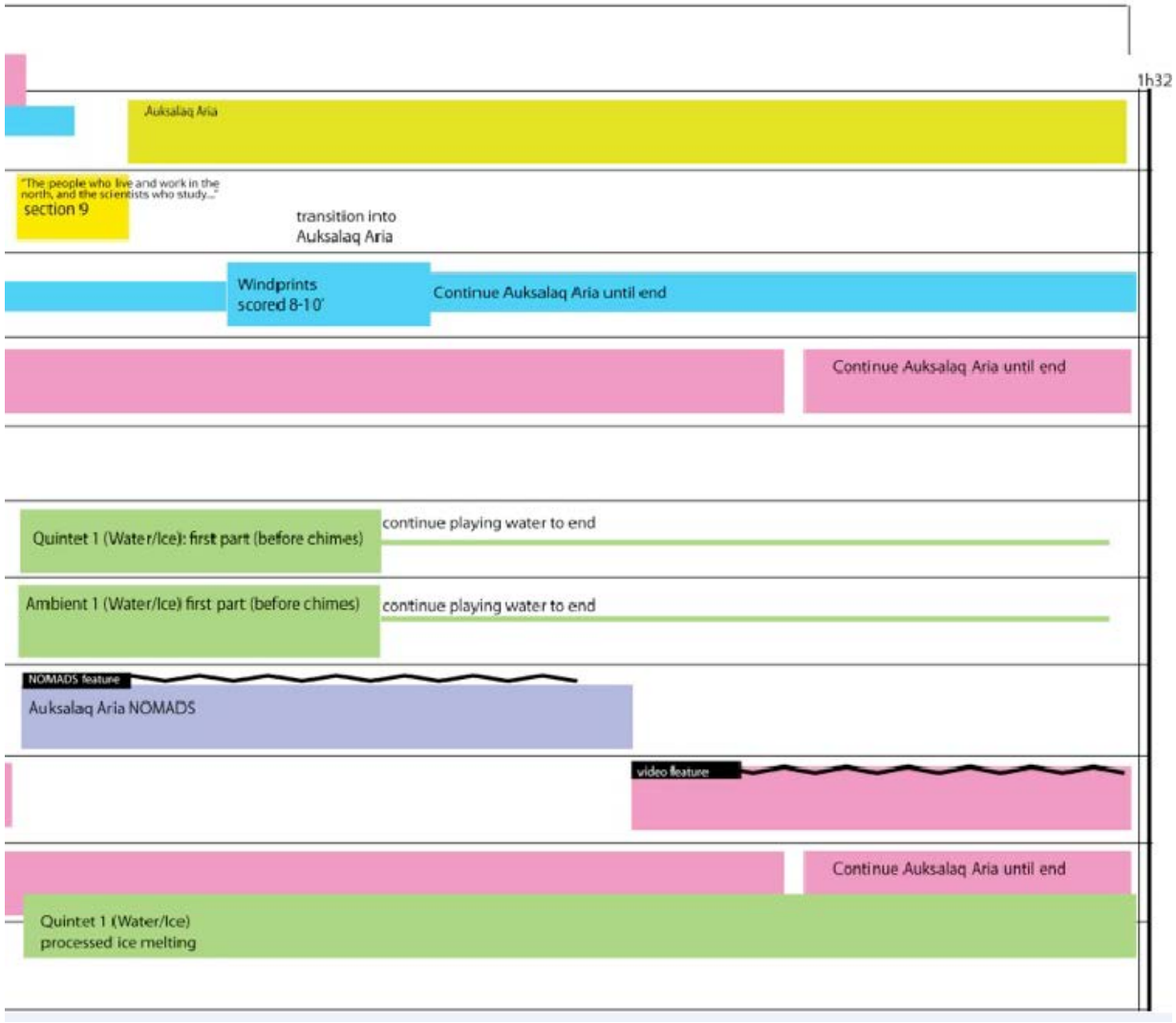
SECTION 2


51
57:30
1h02'
1
Cloudprints 3 introduction
fff
/p
Cloudprints 3 introduction
Quintet 5 (air)
Quintet 6 (skin)
Ambient 5 (air)
Ambient 6(skin)
Voices of 2020
here less of the voices of 2020 because the music is loud
video feature
Quintet 5 (air)
Quintet 6 (skin)
noise


1h02'
1h04'
1h05'
1h06'
1h07'
1h08'
1h09'
1h10"
1h12'
Cloudprints 3 introduction
Singing on all chords
Cloudprints 3 Aria
fff
/p
Cloudprints 3 introduction
Cloudprints 3 (Cirrus)
Cloud 1
Cloud 2
Cloud 3
Cloud 4
Cloud 5
Cloud 6
Cloudprints 3 Aria
video feature
noise
Cloudprints 3 (Cirrus)
noise part
noise

SECTION 3


1h12'
Into an Ocean"
(cue from "an ocean")
Windprints Ambient vocal part
"vaporous clouds condense" sung to Quintet 2' (Wood/Pitch)
Windprints Sung part
Windprints Ambient vocal part
Ice Quintet ("a changing place, a distant place")
Sung part during "Water/Ice" tubular bells part (1:40-5:40)
"The people who live and work in the north, and the scientists who study..."
section 8
Ambient for 8'
Windprints scored 4-8'
Ambient for 4'
Iceprints piano (5-26)
Cloudprints2
Cloudprints 1
"Iceprints" sub-ice ecoacoustics
Iceprints piano (5-26)
Quintet 2' (Wood/Pitch)


1h32
Auksalaq Aria
"The people who live and work in the north, and the scientists who study..."
section 9
transition into
Auksalaq Aria
Windprints
scored 8-10'
Continue Auksalaq Aria until end
Continue Auksalaq Aria until end
Quintet 1 (Water/Ice): first part (before chimes)
continue playing water to end
Ambient 1 (Water/Ice) first part (before chimes)
continue playing water to end
NOMADS feature
Auksalaq Aria NOMADS
video feature
Continue Auksalaq Aria until end
Quintet 1 (Water/Ice)
processed ice melting